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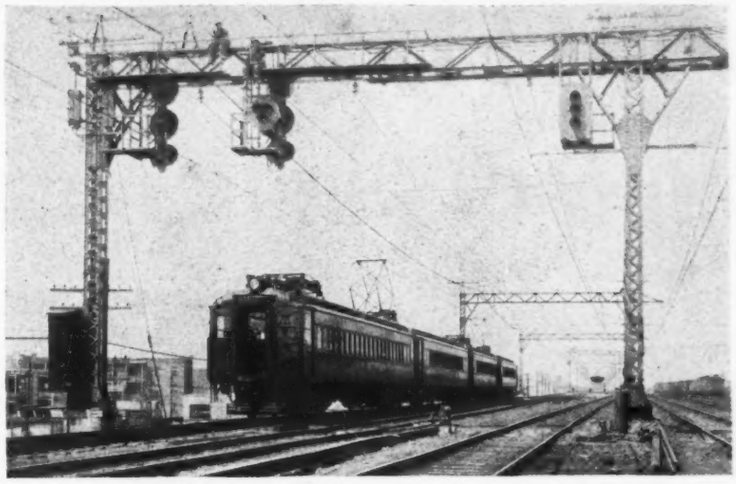

Illinois Central Suburban Electrification, Chicago, Ill.

SEPTEMBER 20, 1930

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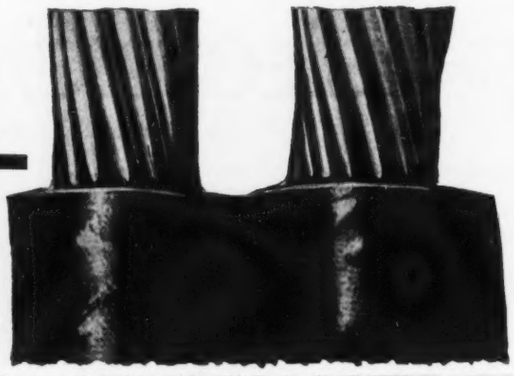

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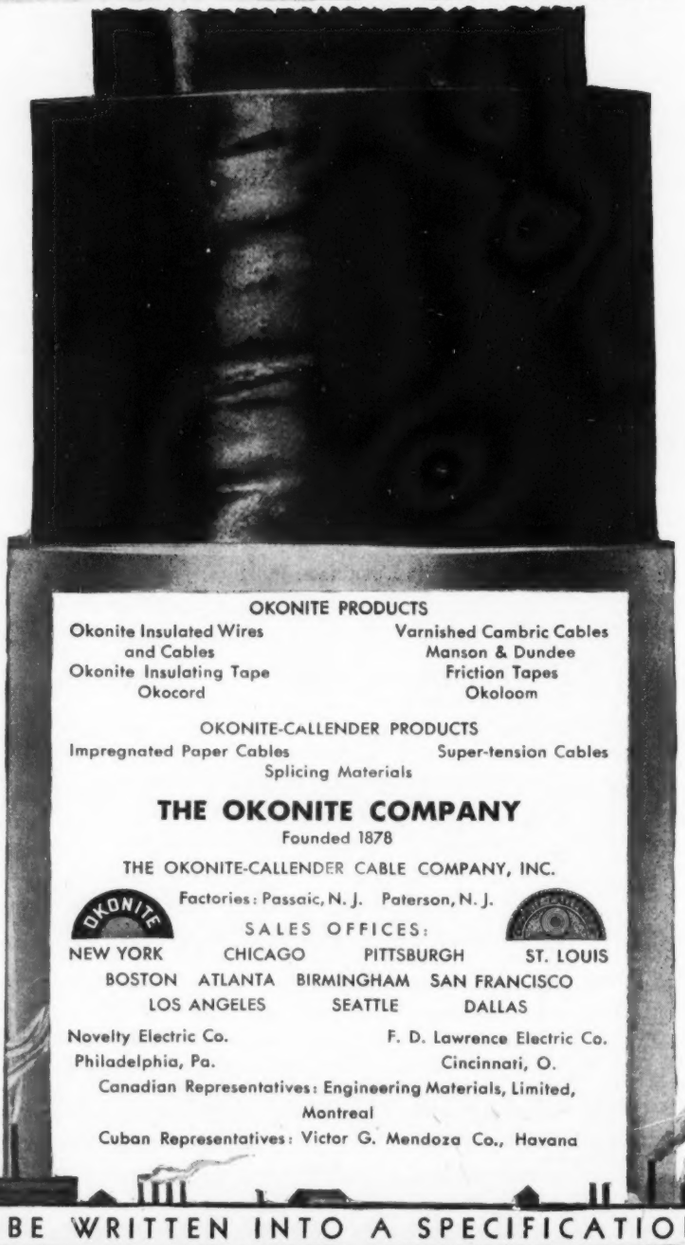

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ELECTRICAL WORLD

for the Week Ending

September 20, 1930

Wiring costs too high, inspectors told

Copper at lowest price in 30 years

Power Commission's authority denied

California election expenses approved

—WIRING COSTS too high, John F. Gilchrist, Commonwealth Edison, tells electrical inspectors' convention and "super-safety" requirements unnecessary. Criticises Underwriters' Laboratories and the code.

—JET-WAVE RECTIFIER, operating on purely mechanical action of mercury column following oscillation of impressed alternating current, successful in 200-kw. installation.

—USE OF ENERGY for manufacturing shows slight rise. Reports from selected list indicate gain by automobile, rubber, food and steel groups.

—COPPER, at 10¾ cents, hits lowest price in 30 years. Sales small, production largely profitless, further reductions in output anticipated.

—POWER COMMISSION accountants' jurisdiction over projects on non-navigable portions of navigable streams challenged by Columbus (Ga.) Electric & Power Company.

—NEON LAMPS for every one? R. R. Machlett, a pioneer in luminous-sign field, predicts a new era in home and office illumination.

—GERMANY produced 31,000,000,000 kw.-hr. in 1929 with an installed capacity of 12,400,000 kw. United States operates with a 25 per cent higher use factor.

—CALIFORNIA COMMISSIONERS divide over election expenses of local utilities and time of employees devoted toward defeat of municipal projects. Majority clears companies.

NEWS OF THE WEEK

Gilchrist Criticises Electrical Code and Underwriters' Laboratories

THAT extreme ideas of safety to property and life—ideas not justified by facts—have hampered and are hampering the growth of electric service was forcibly contended in the address of John F. Gilchrist, vice-president Commonwealth Edison Company, before the convention of the Western Section, International Association of Electrical Inspectors, in Chicago this week. Mr. Gilchrist uttered some very pertinent thoughts on costs of wiring, the Underwriters' Laboratories, the formulation of the National Electrical Safety Code and the interests of insurance companies and governments in electric wiring.

Summarizing the principal differences between the insurance inspector and the central station from the standpoint of the utility interests, Mr. Gilchrist, addressing his audience directly, said:

"We feel that it is made to appear by you that the hazards in using electricity are very much greater than they really are, and that in all electrical installations, apparatus and appliances you are attempting to secure a high degree of super-safety almost without regard for cost of materials and apparently ignoring the fact that this, resulting in a constantly increased cost of wiring and a greatly restricted use of electricity, is working a very great injury to the public at large. We believe that this attitude results in your being exploited by certain manufacturers of electrical material who are interested only in having their material used, regardless of whether or not it is necessary from the standpoint of safety and absolutely regardless of the effect of such use on the rights of the people and on the industry generally."

Dwelling on the belief that the hazards appertaining to the use of electricity have been exaggerated to the public and that comparatively few fires are due to improper or defective wiring Mr. Gilchrist continued:

"The National Electrical Code has been and continues to be of service, but we feel that it might be simplified and much detailed material not definitely related to the avoidance of hazard eliminated from it. It is obvious that in the creation of the present code the technical side of the insurance interests, the manufacturers of devices and materials and, to a certain extent, the contractors who install them have been parties to the compilation; but the evidence is lacking that the public utilities, the broad business side of the insurance companies, or the representatives of the public concerned with the great advantages accruing from the widespread use of electricity, had any substantial participation."

Mr. Gilchrist went on to condemn listing by the Underwriters' Laboratories "in conformity to specifications of a private nature and which generally have no proper sanctions, having been drafted and adopted by the Laboratories alone or in co-operation with organized electrical manufacturers."

"It is not the cost of power itself," declared the speaker, "but the cost of the equipment necessary to the extension and use of the service, that is the great obstacle, the bar which more than anything else is preventing the general enjoyment of the advantages of electricity. Unfortunately, the cost of equipment seems to be mounting or at best standing still, and this condition is being tolerated—in some cases aided and abetted—by those who are being most injured by it."

Venturing the statement that ten thousand housewives die from overwork where one loses her life because of defective wiring, and painting a picture of the amelioration of domestic tasks that electric service brings, Mr. Gilchrist said that overemphasis on safety often "grows out of sales talk and not to any extent out of actual cases of injury and damage." "It is my firm belief," he concluded, "that a great benefit to humanity and a great benefit to business institutions will ensue from the development of cheap, safe, serviceable systems of electrical installations and apparatus and appliances. If you will work with us and we will work with you, these great advantages can be brought about."

Dr. M. G. Lloyd, A. Penn Denton and Secretary William S. Boyd were others who addressed the section, which held sessions from Monday to Wednesday, with tours of inspection on Thursday.

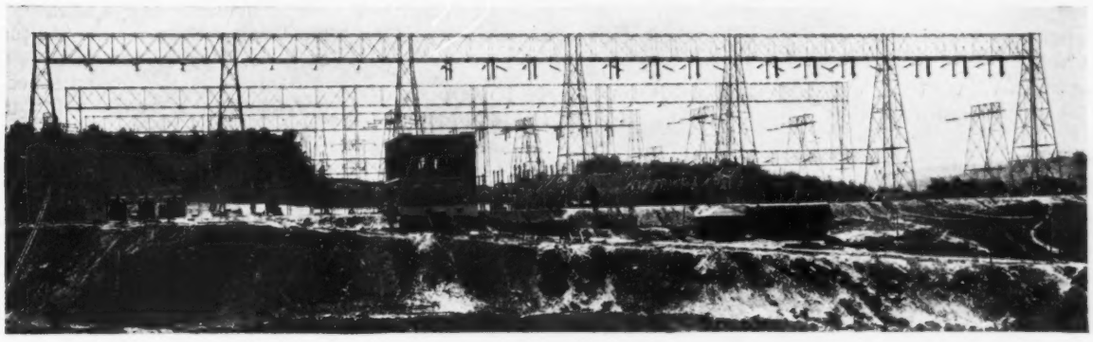
Mr. Denton, a representative of the N.E.M.A., pointed out the great difference between adequacy of electric wiring considered in the light of code safety requirements and adequacy as related to the fullest utilization of electric service. Dr. Lloyd gave an analysis of 187 fatalities from electric shock where the voltage was 240 and less.

SOUTHERN LIGHTS

—P. & A. Photos

The aurora borealis, Nature's lighting spectacle in the Far North, was rivaled at Hollywood, Calif., recently when merchants in the motion-picture colony staged an advertising display.

HOOVER WILL START FIFTEEN-MILE FALLS PLANT ON SEPTEMBER 30



Columbus (Ga.) Company Challenges Federal Board

SWEEPING challenge of the right of the Federal Power Commission, through its accounting division, to supervise investment costs set up by a hydro-electric company which builds a plant on the non-navigable reaches of a stream, where no possible interest of interstate or foreign commerce can be affected, is the answer of the Columbus (Ga.) Electric & Power Company to the federal accountants' recommended elimination of items in the company's statement of costs for its Bartlett's Ferry development on the Chattahoochee River.

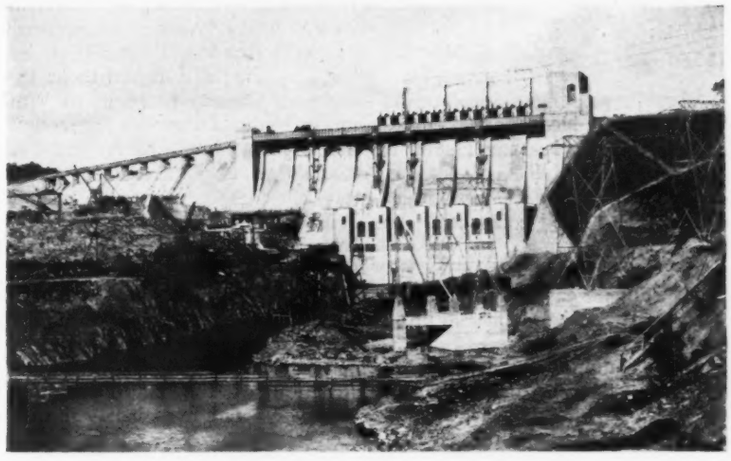
The items proposed for elimination total $646,040 and include $459,249 for construction fees paid to Stone & Webster, at that time executive managers of the property, which is now part of the Commonwealth & Southern system.

▼

Maltbie Declares for Full Rate Publicity

BEFORE the Empire State Gas and Electric Association, in convention at Saranac Inn, N. Y., Chairman Milo R. Maltbie of the New York Public Service Commission, speaking on "Rate Making," declared on Thursday that there are utilities in the state which have special contracts unknown to other consumers that virtually amount to discriminatory and preferential rates. He asserted that this condition is a violation of the spirit and the letter of the Public Service Commission law and said:

"There should be a place in each locality where every customer, present or prospective, may examine freely and without hindrance all of the rates which are in effect and where he may determine not only what his competitors or associates in the same class are required to pay for the service rendered, but where he may ascertain what every one is paying for service."



The 200,000-hp. initial hydro-electric development of the New England Power Association on the Upper Connecticut River is on the point of readiness and will go into commercial service at 10.30 a.m. on September 30, when the President presses a button at the White House. Here are shown, a view of the power house taken from downstream on September 15 and one of the 220-kv. switching station on the New Hampshire side of the river.

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Roosevelt Interested in Street-Lighting Rates

IN A LETTER written on September 15 by Gov. Franklin D. Roosevelt of New York to W. P. Capes, executive secretary of the State Conference of Mayors, the Governor points out that the Public Service Commission has the same power to fix rates for street lighting or other service to municipalities that it has over rates for service to private communities. Mr. Capes had written to the Governor: "The officers and advisory committee, acting for the conference, believe that the Public Service Commission can and should help the municipalities to obtain equitable street-lighting rates and proper service."

The Governor agrees that "the commission should assist municipalities to the limit of its authority and means." "If it develops," he says, "that additional authority or funds are needed by the commission to deal adequately with the situation, I shall be glad to recommend changes in the law and sufficient appropriations to bring about the desired results."

▼

Boulder Dam Takes Name of President

DRIVING a silver spike into a tie for the railroad which is to be built to connect the Boulder Dam site with Las Vegas, Nev., Secretary of the Interior Wilbur on Wednesday formally rechristened the great governmental development Hoover Dam in honor of the President, to whom he gave the credit for starting "this greatest project of all time."

This was the official recognition that the work of building has begun. Dr.

Elwood Mead, Commissioner of Reclamation, and other government chiefs were present, as were delegations from the Metropolitan Water District of southern California and many southern Californian cities. Six of the Colorado Basin states sent representatives—California, Nevada, New Mexico, Utah, Colorado and Wyoming—but Arizona, which will contest the constitutionality of the Boulder Dam act in the United States Supreme Court, flatly refused Secretary Wilbur's invitation to participate in the ceremonies.

▼

N.Y. & N. H. Orders Ten Passenger Locomotives

TEN electric passenger locomotives will soon be added to the equipment of the New York, New Haven & Hartford Railroad, which has placed an order for them with the General Electric Company. The cost will be $2,000,000.

The new locomotives will move fifteen 80-ton Pullman cars up to 65 miles an hour on alternating current and up to 58 miles an hour on direct current. They will be equipped for both kinds of electricity so that, besides operating between New York and New Haven, they may be run in the direct-current zones of the Grand Central and Pennsylvania stations. They will be of 3,500 hp., of 200 tons weight and will be built at Erie, Pa. Delivery is expected next August.

▼

Progress Perceived on St. Lawrence Waterway

IT IS intimated in parliamentary circles in Ottawa that Canada will be ready to enter into negotiations with the United States looking toward a treaty for the development of the St. Lawrence waterway soon after the conclusion of the imperial conference which opens in London, England, on September 30. This is believed to be in effect the note Canada has sent to Washington in reply to a recent suggestion from the United States government that further negotiations be started.

While the contents of the reply to the Washington communication have not been divulged, it is understood that the United States was advised that Premier R. B. Bennett would be ready to take up the negotiations very soon after his return from London. One of Mr. Bennett's election pledges was the construction of the St. Lawrence deep waterway, and it is believed that once the emergency session of Parliament dealing with unemployment is over and the meetings of the imperial conference are concluded, the Canadian government will seek to further the plans with as little delay as possible.

As regards the power aspect of the development, it remains for the Joint International Board of Engineers to agree on the plans (ELECTRICAL WORLD, July 12, page 51). The most intricate problem before the treaty commissioners will be the division of costs between the two countries.

▼

Sale of Energy Theme of Maryland Utilities Meeting

CO-ORDINATION of efforts to promote greater use of energy in rural and urban territories was urged by C. E. Greenwood, commercial director N.E.L.A., at the midyear meeting of the Maryland Utilities Association during a Chesapeake Bay cruise last week. Rural customers should not be penalized in making installations by unnecessarily rigorous insistence upon code specifications, George W. Kable, director of the national rural electric project in Maryland, told the meeting, in expressing the opinion that the cost of wiring on farms was often too high to carry much promotional value. That public relations depend upon performance, the spoken word and the written word, was the moral driven home by W. S. Vivian, vice-president Middle West Utilities Company and chairman N.E.L.A. public speaking committee.

About 250 members and guests were on the cruise, which started from Baltimore and included Jamestown and Yorktown, Va.

▼

Southern Inspectors Meet at Jacksonville

PROGRESS of research into the phenomena of lightning as they affect transmission of electricity was related by Dr. M. G. Lloyd of the Bureau of Standards before the second annual meeting of the Southern Section of the International Association of Electrical Inspectors, held at Jacksonville, Fla., on September 8 to 11.

Nine states—Florida, Texas, Louisiana, Mississippi, Alabama, Georgia, Virginia, North Carolina and South Carolina—were represented at the convention, which heard, among others, President William S. Boyd and Secretary V. H. Tousley, Chicago, of the national association; President L. T. Rogers, Shreveport, of the Southern Section; A. Penn Denton of the

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PERSEVERANCE WINS FOR GEORGES CLAUDE

—P. & A. Photos

As recorded last week (page 467), the third attempt of Georges Claude, French scientist and inventor, to sink a mile-long power tube in the Gulf Stream off the Cuban coast was crowned with success. It now remains to be seen whether his plan to generate energy will prove practicable.

N.E.M.A.; A. J. Bommer, an engineer in the underwriters' laboratory of Dallas; A. R. Small of New York, chairman of the code committee, and H. L. Wills of the Georgia Power Company. Several valuable technical papers were read.

H. N. Pye, Atlanta, was elected president; C. S. Graham, Jacksonville, first vice-president; E. L. Kenderdine, Fort Worth, Tex., second vice-president, and R. L. Gatewood, Atlanta, was re-elected secretary-treasurer.

▼

Second Paugan-Toronto Line Goes Into Service

A SECOND 230-mile transmission line from the Paugan (Quebec) hydro-electric plant of the Gatineau Power Company to Toronto has been placed in commercial service. The new line is a 220-kv. steel-tower aluminum line, a duplicate of the first one, and is being used in conjunction with it for the delivery of power under contract to the Hydro-Electric Power Commission of Ontario.

The two lines are about 100 ft. apart and are operated at the highest transmission voltage used in Canada. Over these lines the Gatineau Power Company is at present delivering to the commission 150,000 hp., which is being distributed in the Toronto area to supplement the power supplied from Niagara Falls. The standard tower of the new line is 73 ft. in height and the average distance between the towers is one-fifth of a mile, but the longest span is twice that distance.

The contract under which electric power is being delivered over the lines is one of three which the Gatineau company has with the Hydro commission. It runs for 30 years and calls for an eventual delivery of 260,000 hp.. The Paugan station has a designed capacity of 272,000 hp. and is one of the company's four plants on the Gatineau River, which have an aggregate installed capacity of 438,500 hp.

▼

Remotest Ontario Gets Hydro-Electric Plant

FOR a year and a half the Ontario Hydro-Electric Power Commission has been engaged in the design and construction of projects in the far northwestern part of the province, more particularly at the outlet of Lac Seul, an enlargement of the English River, which is one of the main tributaries of the Winnipeg. The projects have included a conservation dam and a power house at Ear Falls, on Lac Seul, and supervision of a 40-mile transmission line built by mining interests between Ear Falls and Red Lake. The Ear Falls site, now provided with a 5,000-hp. turbine, is capable of delivering 30,000 horsepower.

▼

Two States Would Tax Boundary Power House

UNTIL the United States Supreme Court hands down a final decision as to whether the Rio Grande power plant of the El Paso Electric Company is in Texas or New Mexico the company will withhold payment of taxes, according to announcement of F. J. Gannon, president.

The power plant is situated on a strip of land claimed by both states. The land, lying along the Rio Grande and north of El Paso, was awarded to New Mexico in a recent survey ordered by the United States Supreme Court. However, the survey has not been finally approved and Texas still claims ownership of the plant and the right to continue to tax it. The State Tax Commission of New Mexico recently assessed the property at $1,500,000. The Supreme Court is expected to rule on the boundary of the two states in October.

MINNEAPOLIS HAILS NEW "WHITE WAY"

Public interest in brilliant street lighting was recently evidenced in Minneapolis, when 50,000 persons jammed Nicollet Avenue to see a new system inaugurated. The lamps are mounted on 23-ft. standards.

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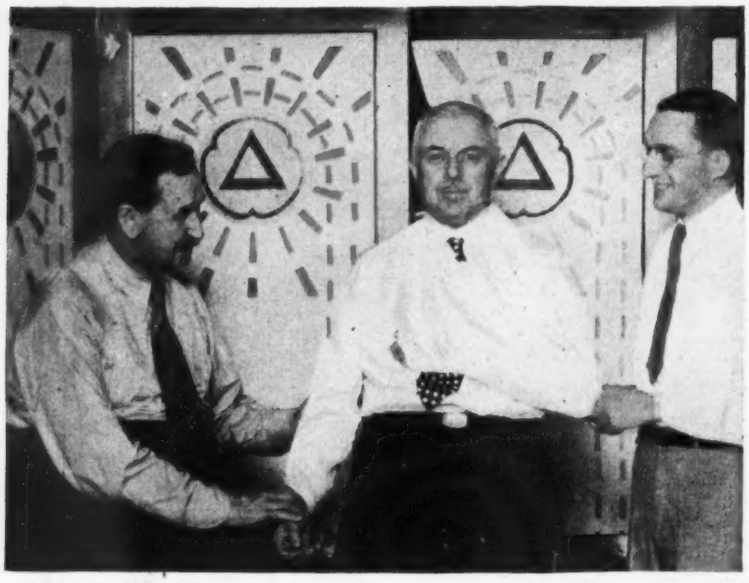
September and October Convention Programs

THREE geographic divisions of the National Electric Light Association will hold their annual conventions in the five weeks just ahead—the Great Lakes Division at French Lick, Ind., September 25-27; the New England Division at Swampscott, Mass., September 29-October 1, and the Rocky Mountain Division at Albuquerque, N. M., October 20-22.

In the Great Lakes program are included addresses by President Jones and Managing Director Clapp of the national body, President Eugene Holcomb of the division and others prominent in association work. Henry S. Ives, counsel for the Association of Casualty and Surety Executives, and James L. Madden, Metropolitan Life Insurance Company, will speak; O. C. Merrill will describe the World Power Conference at Berlin; W. L. Willkie, counsel Commonwealth & Southern Corporation, will talk on regulation, and Halford Erickson, vice-president Byllesby Engineering & Management Corporation, will be heard from. Selling, rates and public relations will be leading topics.

President Jones and Managing Director Clapp are also scheduled to address the New England Division, as are Fred W. Herbert, accounting director, and A. D. Bailey, chairman of the Engineer-

COLORADO EXECUTIVE HELPS "FIRST AID" CLASS



To emphasize the importance which the Public Service Company of Colorado attaches to training in first aid, Vice-President Clare N. Standard consented to pose as a "patient." Nearly 500 employees and officials recently took an intensive two weeks' course from Bureau of Mines instructors.

▼

ing National Section. Other addresses include: "Floating Power Station," by E. C. Bennett, naval architect, New York; "Proper Voltage and Lighting Service," by George S. Merrill, Edison and National Lamp Works, and "Public Relations South of the Equator," by H. T. Sands of the Electric Bond & Share Company. All the divisions of the work in New England will be covered in the usual varied program.

Messrs. Jones, Clapp and Sands are expected to be at Albuquerque. Here Mr. Sands will take as his subject "The Effect of General Business on Load Building," and Floyd F. McCammon, Public Service Company of Colorado, will discuss industrial relations. Seven Indian tribes will participate in a historic pageant. The convention will mark the absorption into one organization of the Colorado, Wyoming and New Mexico utilities associations, these bodies meeting for the last time concurrently with the Rocky Mountain Division, N.E.L.A., into which they will be merged.

Other early fall conventions with an electrical interest are those of the American Welding Society at Chicago, September 22-26, the American Electrochemical Society at Detroit on September 25-27, the Public Utilities Section of the National Safety Bureau at Chicago on September 30-October 2, the Philadelphia meeting of the A.I.E.E. on October 13-15, and the National Electrical Manufacturers' Association at Old Point Comfort, Va., on October 20-24. The program of the Illuminating Engineering Society, meeting at Richmond on October 7-10, is noted below.

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I.E.S. Program for Richmond Convention

FOLLOWING a pre-convention meeting on October 6, when subcommittees on lighting service will report and W. H. Horton, Jr., will deal with the N.E.L.A. plan book on architectural contact service, there will be morning and afternoon sessions of the Illuminating Engineering Society on October 7 to October 10 inclusive at the John Marshall Hotel, Richmond, Va., the occasion being the society's twenty-fourth annual convention. Recreation and entertainment will be abundantly provided. Among the papers presented will be:

"Automatic Control of Light," E. H. Vedder and S. G. Hibben.
"Tailor-Made Lighting," A. A. Brainerd.
"Lighting Plus Vision Equals Seeing," M. Luckiesh and F. K. Moss.
"Floodlighting from Ornamental Standards," W. T. Blackwell and Charles Gallo.
"Code of Street Lighting," Preston S. Millar.
"Lighting for Architects," S. R. McCandless.
"Relations with Architects," R. B. Brown, Jr.
"Function of the Consulting Engineer in the Field of Illumination," Mortimer Freund.
"Floodlighting, from an Architect's Viewpoint," C. C. Zantzinger.
"Visual Performance Under Daylight, Incandescent Light, Mercury Vapor and Their Mixtures," K. Y. Tang.
"Energy Measurements in the Visible and Ultraviolet," Frank Benford and Rachel F. Howe.
"Erythemal Basis for Dual-Purpose Lighting," M. Luckiesh.
"New Source of Ultraviolet Light," J. W. Marden and M. G. Nicholson.
"Industrial Uses of Ultraviolet," E. E. Free and C. C. Clark.
"Definition and Measurement of Useful Radiation of Ultraviolet Lamps," C. H. Sharp and W. F. Little.

▼

Power Companies Invited to Aid Tennessee Report

IN ACCORDANCE with a provision of the river and harbor act passed this year, the Chief of Engineers, United States Army, will report to the Seventy-second Congress on December 7 of next year concerning the program for the improvement of the Tennessee River, which includes betterment of navigation, control of floods and utilization of water power. Besides public officials, chambers of commerce, producers, shippers and others specially concerned, power companies with actual or contemplated plants in the region watered by the Tennessee are being invited to co-operate by sending Major Lewis H. Watkins, United States district engineer at Chattanooga, an outline of their contemplated moves in this connection.

The army report advocates that navigation be improved by constructing 652 miles of 9-ft. waterway on the main stream and ultimately 1,260 miles of 6-ft. to 9-ft. waterways on its tributaries, outlines a program for flood control and envisages the production of 2,000,000 hp. on the main stream and the same amount on the lesser ones. It points out that the 300-mile radius for distribution of power from the Tennessee basin includes fifteen states in whole or part. The two large existing developments—Wilson Dam and Hale's Bar—and the substitution of high for low dams on the main stream will, it is implied, constitute base projects for economic development with very wide ramifications.

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Tecumseh (Kan.) Plant's Rating Is Doubled

WITH the recent placing in service of a new 25,000-kw. turbo-generator at the Tecumseh power plant of the Kansas Power & Light Company, officials say that the plant is capable of supplying all the towns in the eastern half of the state. It has now four times the capacity provided when it was built in 1925 and twice what it had after expansion in 1927. The total investment in the plant is above $8,000,000.

California Commissioners Dismiss Election Charges

WITH A DIVIDED opinion — Commissioners Clyde L. Seavey and William J. Carr dissenting — the California Railroad Commission has concluded its investigation into expenditures made by the Southern California Edison Company, the Los Angeles Gas & Electric Corporation, the Southern Counties Gas Company and the Southern California Gas Company for political purposes and the diverting of the time and efforts of the employees of those corporations to the advancement of political causes. The "political causes" in question were in connection with a municipal election held on June 4, 1929, in the city of Los Angeles, at which bonds for the development of certain municipal projects were voted upon.

Commissioners Decoto, Louttit, and Whitsell in dismissing the charges held that while the record shows that the Southern California Edison Company expended for election purposes $45,608, the Los Angeles Gas & Electric Corporation $40,282, the Southern California Gas Company $1,683 and the Southern Counties Gas Company $200, it further shows that the expenditures were charged by the companies to their surplus account and no part thereof was charged to operating expenses. The commissioners held that as a result the customers would not be called upon to pay any part of such election expenditures. Commissioner Decoto thought the expenditures within the rightful discretion of the companies' directors.

Furthermore, the majority opinion declared that "the testimony of various witnesses shows that the public utility services rendered by the respective companies were not impaired by the withdrawal of company employees from their regular duties during the election period."

The dissenting commissioners held that the two light and power companies had not cleared their skirts in these respects.

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Coming Meetings

International Association of Electrical Inspectors — Eastern Section, Pittsfield, Mass., Sept. 22-24. R. Walker, 85 John St., New York.

American Welding Society — Congress Hotel, Chicago, Sept. 22-26. M. M. Kelly, 29 West 39th St., New York.

Public Utilities Association of West Virginia—Greenbrier Hotel, White Sulphur Springs, Sept. 22-24. A. Bliss McCrum, P. O. Box 1483, Charleston, W. Va.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Sept. 25-27. T. C. Polk, 20 North Wacker Drive, Chicago.

American Electrochemical Society — Hotel Statler, Detroit, Sept. 25-27. C. G. Fink, Columbia University, New York.

National Safety Council—Pittsburgh, Sept. 29-Oct. 4. W. H. Cameron, 20 North Wacker Drive, Chicago.

New England Division, N.E.L.A.—New Ocean House, Swampscott, Mass., Sept. 29-Oct. 1. Miss O. A. Bursiel, 20 Providence St., Boston.

Illuminating Engineering Society — Hotel John Marshall, Richmond, Va., Oct. 7-10. E. H. Hobbie, 29 West 39th St., New York.

Public Utilities Advertising Association —Atlantic City, Oct. 10 and 11. J. R. Pershall, 72 West Adams St., Chicago.

Empire State Gas and Electric Association—Meter Section, Watertown, N. Y., Oct. 9 and 10. C. H. B. Chapin, Grand Central Terminal, New York.

American Institute of Electrical Engineers—Middle Eastern District, Philadelphia, Oct. 13-15; Southern District, Louisville, Nov. 19-22. F. L. Hutchinson, 33 West 39th St., New York.

American Engineering Council — Administrative Board, Mayflower Hotel, Washington, Oct. 17 and 18. L. W. Wallace, 26 Jackson Place, Washington.

Rocky Mountain Division, N.E.L.A.—Franciscan Hotel, Albuquerque, N. M., Oct. 20-22. O. H. Weller, Public Service Co. of Colorado, Denver.

National Electrical Manufacturers' Association — Chamberlain-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 20-24. A. W. Berresford, 420 Lexington Ave., New York.

National Electrical Wholesalers' Association—Pittsburgh, Nov. 10-14. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners—Charleston, S. C., Nov. 12-15. J. B. Walker, 270 Madison Ave., New York.

Opposition Expressed to Cheat River Project

CONSIDERABLE opposition to the plans of the West Virginia Power & Transmission Company, a West Penn Power Company subsidiary, for the development of the Cheat River watershed was manifested when the license granted by the Public Service Commission of West Virginia for this project was attacked last week in the Kanawha County Circuit Court on the grounds that the commission's investigation was insufficient, that the exportation of power would be detrimental to the state's interest and that the proposed development would not attract industry to the state.

Gray Silver of Martinsburg, formerly national legislative representative of the American Farm Bureau Federation; Prof. E. H. Vickers of the University of West Virginia and United States Senator H. D. Hatfield were among the opponents who gave testimony in a three-day hearing. The court declined to conduct an independent investigation of the project and, when the arguments are closed, will base its decision on the record presented by the Public Service Commission and the additional evidence given at the legal hearing.

State Line Company Changes Its Name

BY AN amendment to its articles of incorporation which became effective September 5 the name of the State Line Generating Company, whose plant at Hammond, Ind., furnishes energy to four large Insull operating companies, was changed to Chicago District Electric Generating Company.

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AT ARIEL DAM ON THE LEWIS RIVER, WASH.

Left to right: H. F. Lincoln, superintendent of construction Phoenix Utility Company; O. L. Le Fever, superintendent Northwestern Electric Company; Lyman Griswold, consulting engineer, Inland Power & Light Company; W. J. Dennis, assistant general manager Northwestern Electric Company; L. T. Merwin, vice-president and general manager Northwestern Electric Company.

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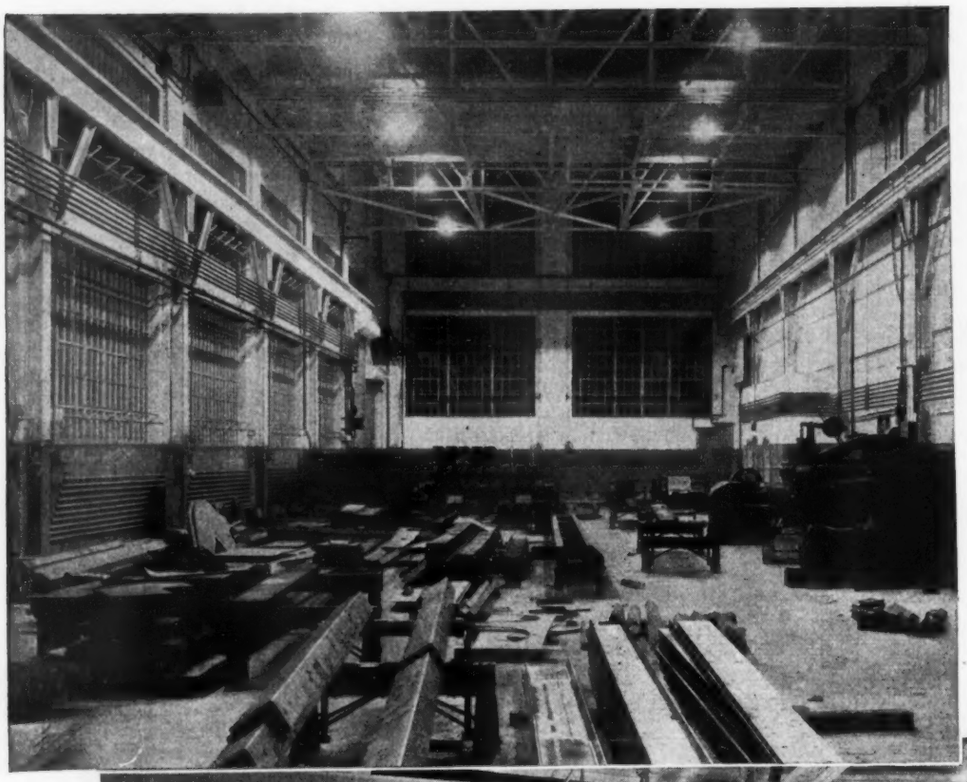
Five Rate Cuts Since 1926 Made by Oklahoma G. & E

J. F. OWENS, vice-president and general manager Oklahoma Gas & Electric Company, has announced reductions in residential and commercial lighting rates affecting 210 towns in the company's system. This is the fifth voluntary rate reduction made by this company in the last four years. It follows closely a similar reduction made a year and a half ago.

Numerous reductions in street lighting, water pumping and power rates to industrial users of electricity have also been made in recent years. The new rates become effective with bills rendered on and after October 1.

BETTER LIGHTING "TOOLS UP" PRODUCTION



Fumbling to find lines and points on drawings in the office and on material in process is a thing of the past in plants like the Morgan Construction and Heald Machine companies at Worcester. Modern lighting at high intensities with shadowless distribution on the working plane turns night into day

EDITORIALS

L.W.W.MORROW
Editor

Action for better business

A SURVEY of the opinions of utility executives in all sections of the country brings the general opinion that the worst of the business depression is over and that a slow upward turn is under way. These opinions check with those of economists who study the present situation. Industry is on a dead center.

The opinions will have of themselves little effect unless business puts its hand to the wheel and throws the commercial engine off this dead center. Purchases of raw materials and other commodities are good business, and they also exert a good influence to start commercial wheels running. Copper, steel and iron are on a price and delivery basis that has encouraged some electrical organizations to buy large supplies recently. Others can well do this. Fuel supplies can be purchased without delay. Electrical equipment and appliance manufacturers are in a good position to make and sell. The credit position of the electrical industry is good and money is available. Action in buying, dictated by good business principles only, is the great need of the depressed industrial organization.

Public relations organization

GOOD service, efficient operation and reasonable charges are not sufficient. The public expects these things and pays for them. On top of these basic foundations to a successful corporate business enterprise must be erected a mechanism to get and maintain good public relations.

As pointed out recently by James L. Madden, every corporation must have a sound public relations policy as an integral part of its program. Each employee from the president to the office boy must be public-relations-minded and must be informed about the business to the extent necessary to discuss it in every-day encounters. Employees must be alert to opportunities for making friends for the company in the same degree that they are alert to the opportunities in their other business activities. The public expects each employee of a corporation to be alert, courteous, efficient and informed about the business enterprise with which he is connected. There is no substitute for the personal contact of employee and customer —advertising and publicity merely supplement it.

In the light and power industry three hundred thousand employees can be organized into a public relations mechanism. Time, money and organization should be devoted to training and informing all of them about the industry, and this public relations mechanism must be directed by a full-time competent executive. This is the program announced by Harry Reid of the N.E.L.A. Public Relations National Section. It is constructive and should be supported.

Enter Fifteen-Mile Falls

AHEAD of schedule on construction, the Fifteen-Mile Falls development of the New England Power Association on the Upper Connecticut River is at this writing about to begin commercial service. The 220-kv. line will be watched with close attention as it operates under the exacting grind of continuous performance to supply bulk energy to the metropolitan market which is at present the chief outlet for this up-river energy.

Apart from the engineering aspects of the development, which represents an ultimate cost

of about $40,000,000, the steps immediately preceding and associated with it signify much in the New England power situation. A 110-kv., two-circuit transmission ring has now been established from the Edgar steam plant of the Boston Edison company through the Worcester district to Tewksbury and Woburn, where lower voltage connections with the Edison system complete the loop. This ring constitutes an intersystem tie bus which improves the "hook-up" previously existing between the steam plants of the Power Association, the Edison company and others and the hydro-electric plants of the interior. The advent of Fifteen-Mile Falls energy makes a new source of hydro-electricity available to the co-operating companies.

It may confidently be expected that the regional ring bus now in use at 110 kv. will permit further operating improvements in the local areas which it traverses, leading to the shutting down of inefficient isolated and municipal plants, the purchase of more and more energy in contiguous areas, and more flexible system handling by both large and small companies. New England is to be congratulated that its power development is proceeding along the lines of such a well-proportioned utilization of interconnected steam and water-power facilities.

Substation steel cost should not hamper design

COST of steel should not be a determining factor in outdoor substation design. In the most expensive designs the steel cost seldom exceeds 6 per cent of the station cost. If the transformer and breaker costs are included, the steel may be only 2 to 3 per cent of the total cost. There are cases on record in which the difference between the estimated price and the actual purchase price of transformers and breakers was more than the total cost of the steel. A saving of as much as 20 per cent on steel would not effect a saving of more than three-twentieths of 1 per cent of the total cost of the station.

However, this does not mean that the steel design is of such small importance that it can be turned over to the office boy. The time now spent in trying to effect savings in steel cost could be more profitably devoted to standardization. A skillful steel designer would have the opportunity to do a good job if unhampered by the consideration of cost. Where braces, ties, rods, diagonals and so forth are used to save steel, the electrical designer finds it very difficult to obtain clearances without awkward arrangements of conductors or even increasing the number of insulators. Frequently an architect, by a few changes here and there without much additional expense, could improve the appearance of outdoor substations.

Lightning interruptions are still on the increase

OUR knowledge of lightning magnitudes and frequency has been substantially enlarged as a result of the theoretical and field investigations of the last few years. In spite of this progress lightning is still the primary cause of circuit interruptions; and, even more distressing, the interruptions per hundred miles appear to be definitely increasing. At least, this is the experience reported by the Great Lakes Division, N.E.L.A., on 300 transmission lines of wide range of voltage and totaling nearly 10,000 miles in length. Trip-outs from causes other than lightning also are increasing, but this is small consolation to the transmission engineers in their effort to master lightning.

Comparable groups of 100-kv. lines show an increase from 5.8 to 7 interruptions per unit length in the last three years; trip-outs from all causes correspondingly rose from 8.8 to 16. These were all on lines protected by one or more ground wires. For lines without ground wires all these figures were more than twice as great. Such experience should go far to end the declining argument about the efficiency of the ground wire.

Grounding of the supports is, of course, much more common on the high-voltage lines than on those between 27 kv. and 60 kv. The efficacy of this practice for the former is shown in the ratio of the index figure of 7.0, as against 9.1 for the ungrounded structures. In the field of the lower voltages the interruptions per hundred miles are

twice as frequent on ungrounded lines as on grounded lines—statistical corroboration again for those who contend for the grounding practice.

Undoubtedly the increase in interconnected generating capacity, greatly increased interconnected mileage and more prompt and sensitive relaying have accentuated the interrupting potentiality of all surges. Nevertheless, the goal of the transmission engineer is the ultimate elimination of service interference from lightning, and his success will be measured in terms of his independent accomplishment. For the present it appears that more progress is being made in reconnoitering the character and magnitude of Jove's forces than in formulating the tactics that will encompass that atmospheric general's defeat. The wielder of thunderbolts is still a formidable, diffusive and elusive enemy.

Electrically heating a home—500 per cent efficient

SOMETHING for nothing: May electric heating be 500 per cent efficient? It is if the definition of efficiency remains the ratio of the heat produced to the heat equivalent of the energy supplied. As related in a recent issue of the ELECTRICAL WORLD, T. G. N. Haldane has successfully demonstrated the possibilities of producing low-grade heat by a reverse Carnot-cycle heat engine. With this engine, driven by an electric motor and operating on the reversed refrigerating principle, Mr. Haldane has for two years, by means of a 5-kw. installation, heated his home in England in winter, obtained ice and warmed the hot-water supply. The mere heat equivalent of one kilowatt-hour, or 3,414 B.t.u., is not accepted, for several times that equivalent is obtained by "pumping" heat from one medium to another. Thus outside air or water from the house service pipes serves to furnish the heat needed through what is substantially a refrigerating machine.

It is too early to predict a wide repetition of Mr. Haldane's interesting performance. The heat is "low-grade"—that is, gives a relatively low temperature to the medium to which it is imparted—and for the present at least other methods must supplement this scheme where hot water for domestic purposes is required. The maximum temperature which the warmed water will otherwise reach is 100 deg. F. But something else has been accomplished of particular moment, for a well-known principle, widely employed, has been put to a new use and a further task to which electrical energy is peculiarly fitted, and may with unprecedented efficiency be applied, has been found.

Rate hearings not town meetings

AN EDITOR worms his way into a utilities commission session. It is being held in a room that seats about one hundred. The room is filled. Many are standing along the sides and back. The case is one of curtailment of commuter service on a metropolitan railroad. Those sitting are on the edges of their seats straining to hear every word. Most of the interest centers in one station serving at most a few thousand residents. The hearing is adjourned to await the result of a compromise train schedule. The audience withdraws.

Next comes the hearing on an electric rate case affecting several million consumers. The interested parties file in. The room is less than two-thirds occupied. Most of those present are company officials, attorneys and reporters. No one sits on the edge of his seat. The atmosphere is one of desuetude and nonchalance. There may not be a single person present in the pure rôle of affected consumer.

Just wherein rests the difference in attitude and interest? If curtailed transportation service is of more interest to the individual patron than his electric service, this may be a matter either of joy or of gloom to the utility executive—gloom because of the public lack of recognition of the service rendered by electricity to the individual directly and also indirectly through industrial benefits; joy because the presumption is justified that the service has proved its case and that minor changes in rates, whether up or down, are no commensurate tax on the pocketbook. At all events, utility rate cases do not attract the populace. This is both favorable and unfavorable to the promotion by utilities of good public relations.

Impulse Ratio Limitations

By S. MURRAY JONES
and J. T. LUSIGNAN, Jr.
Ohio Brass Company, Mansfield, Ohio

IN ORDER to qualify the time lag or overvoltage properties of a given gap with respect to a given wave, F. W. Peek, Jr., originated the term "impulse ratio."[1] This term has been adopted by a number of others for the same purpose since then.[2,3,4] However, it is usually defined as the ratio of the maximum or crest value of the particular impulse wave to the crest of the 60-cycle breakdown voltage of the particular gap. This neglects the effect of polarity and may lead to serious errors.

IT IS this improper use of the alternating-current breakdown value as the denominator of the impulse ratio that the authors wish to point out and discuss.

IT HAS been known for some time that the direct-current sparkover of an unsymmetrical gap always occurs at a lower voltage when the electrode in the denser field is positive.[5, 6] For example, in the point-to-plane arrangement, the sparkover voltage with the point positive is considerably lower (often 50 per cent or more) than when the point is negative.

It has also been found in laboratory flashovers that the more unsymmetrical the electrostatic field of an insulator assembly or a gap, the lower is its *alternating-current* breakdown voltage, the reductions being greater as the field approaches that of a point-to-plane. An explanation of this was furnished by some oscillographic studies made at Stanford University,[7] wherein it was determined that a point-to-plane sparkover with 60 cycles always occurred on that half cycle when the point

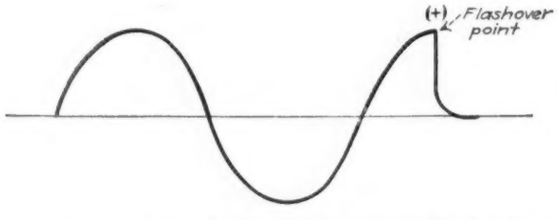


Fig. 1—An a.c. flashover to ground of point-to-plane gap with the point positive

was positive. (See Fig. 1.) This occurred regardless of whether the point was the grounded electrode or not, as long as it was positive.

The same would be true in the case of a suspension insulator assembly. In this case, if the assembly supports a simple conductor (Fig. 2), then the latter would probably have the more intense field about it, and a 60-cycle flashover would always occur from conductor to tower on a half cycle when the conductor was positive. However, should a large, smooth shielding ring be attached to the conductor end of the suspension string, and should there at the same time be some sharp angle or point on the adjacent tower structure which would have a greater field concentration than the enlarged conductor assembly, then flashover would probably take place when the grounded tower point was positive and therefore the conductor negative.

It is because of this polarity effect that the authors wish to point out the fallacy of using the ordinary crest 60-cycle sparkover voltage in calculating impulse ratios.

An additional interesting polarity effect with sphere gaps which emphasizes the need for care in high-voltage sparkover testing was probably found for the first time in this investigation.[7] With the sphere electrodes spaced at distances less than their diameters apart, the gaps were found to display opposite polarity characteristics from the point-to-plane arrangement; that is, the 60-cycle flashovers always occurred on the half cycles when the ungrounded spheres were negative. (The spheres were mounted vertically in a floor frame designed to A.I.E.E. specifications.) As the spacing lengths were increased beyond values equal to the sphere diameters, so that local surface corona probably began to enter.

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[1] *F. W. Peek, Jr., A.I.E.E. Transactions, Vol. 34, 1915 p. 1857.*
[2] *Wade and Smith,* ELECTRICAL WORLD, *Vol. 92, Aug. 18, 1928, p. 309.*
[3] *J. J. Torok, A.I.E.E. Transactions, Vol. 49, 1930.*
[4] *C. L. Fortescue, paper presented at summer convention of A.I.E.E., Toronto, June 23-27, 1930.*
[5] *F. W. Peek, Jr., A.I.E.E. Transactions, Vol. 35, 1916, p. 783.*
[6] *E. Marx, Archiv für Elektrotechnik, Vol. XX, 1928, p. 589.*
[7] *J. T. Lusignan, Jr., A.I.E.E. Transactions, Vol. 48, 1929, p. 246.*
[8] *A. O. Austin, International High-Tension Congress, Paris, June 6-15, 1929.*
[9] *F. W. Peek, Jr., A.I.E.E. Transactions, Vol. 48, 1929, p. 430.*

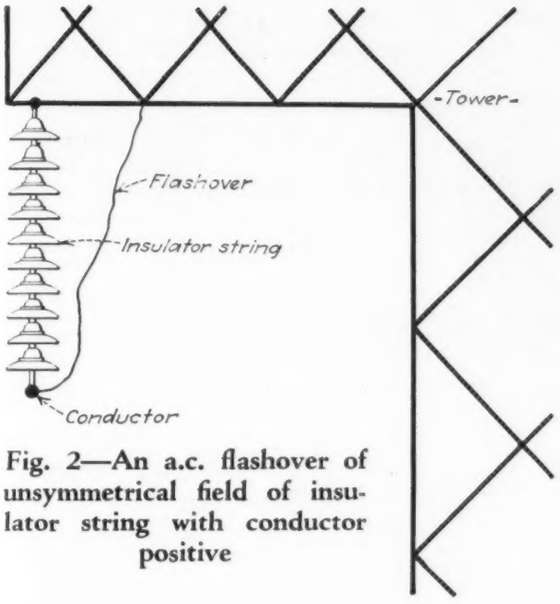

Fig. 2—An a.c. flashover of unsymmetrical field of insulator string with conductor positive

the gaps began to manifest point-to-plane characteristics in that the breakdowns took place for the most part when the ungrounded spheres were positive. This would seem to indicate that the direct-current sparkover of a sphere gap is such that at short spacings it will probably spark over at a lower voltage when the ungrounded sphere is negative, and vice versa at the longer spacings (namely, at gap lengths greater than the sphere diameters.)

A number of investigators have recognized the polarity effect with impulse breakdowns of unsymmetrical gaps.[2,5,8,9] This effect, as with direct-current breakdown, is such that sparkovers of lower voltage occur when the electrode in the denser field is positive. Fig. 3 illustrates this point by showing two similar impulse waves of opposite polarity sparking over a given gap. The time lag and therefore the voltage for breakdown on the positive crest are appreciably less than on the negative crest. The polarity is that of the electrode in the denser field.

Accordingly, the calculation of the impulse ratios of the above gap with a constant value of 60-cycle crest voltage, but with two values of impulse crests, one negative and one positive, gives two ratios, the negative usually appreciably higher than the positive (as much as 25 per cent). However, should the d.c. breakdown values, with polarities corresponding to the impulse polarities, be used for the denominators instead of the single a.c. crest value, then little difference would probably exist between the positive and negative impulse ratios. This, in the opinion of the authors, would give a true numerical characterization of the particular impulse failure.

It is rather difficult (and probably not economically feasible) at the present time to secure the d.c. breakdown voltages of the rather long gaps and insulator assemblies now used in practice. However, as an alternative to this, breakdown values equivalent to the d.c. values could be obtained by means of a high voltage a.c. testing set in which insulator specimens and gaps could be made to flashover on given half cycles. Austin has described one such arrangement which he uses for doing this.[8] The operation is such that an impedance in the circuit is short-circuited at a predetermined zero point of the a.c. wave, so that the succeeding half cycle rises to a sufficient voltage to cause sparkover. This is illustrated in Fig. 4. In this way a positive or negative failure can be made to occur. In his work Austin

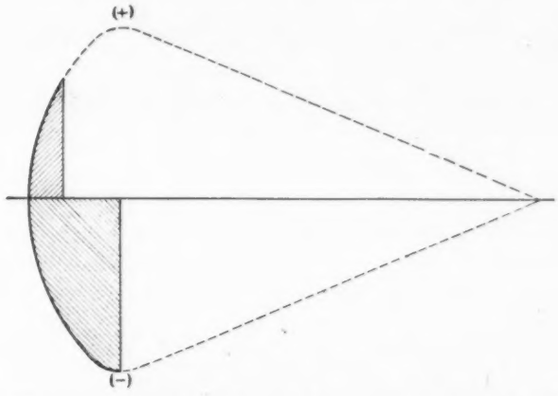

Fig. 3—Impulse breakdown to ground of typical unsymmetrical gap on positive and negative impulses, the latter reaching a higher voltage value before failure

operates at 25 cycles. At such a low frequency electrostatic and space charge conditions closely akin to those in a d.c. field probably exist during each half cycle.

Alternating-current crest sparkover values obtained in the above manner could then be applied to impulse sparkover values of corresponding polarities to secure impulse ratios, which would give accurate numerical characterizations of the particular impulse failures. In his work on a.c. sparkovers with controlled polarities, Austin has found the numerical difference due to polarity with a given gap to be of practically the same order as the difference between positive and negative impulse flashover voltages on the same gap. Accordingly, positive and negative impulse ratios calculated from such values should be practically the same. This

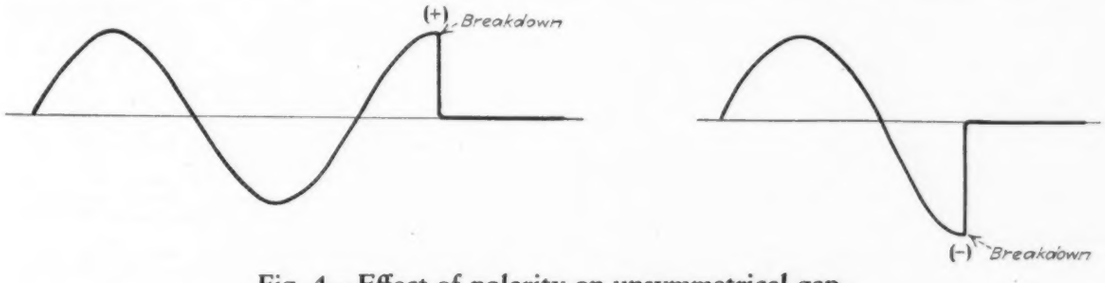

Fig. 4—Effect of polarity on unsymmetrical gap.
Breakdown on positive half cycle lower value than breakdown on negative half cycle

holds for impulses over a wide range of wave shapes. Investigators have usually found that the difference from polarity decreases with short time lags, but that it only becomes small when breakdown occurs within a brief fraction of a microsecond.

The use of the "impulse-ratio" factor gives an interesting characterization of the breakdown properties of a gap expressed in simple unit values. However, ratios calculated with the ordinary a.c. crest flashover voltages as denominators are apt to give values abnormally high and very misleading.

However, with d.c. breakdown values, or a.c. values obtained by controlled polarity means (described above), used as denominators, impulse ratios can be obtained which give a true numerical characterization of the impulse failure.

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Sag Problems Readily Solved by Aid of Alignment Chart

By D. C. STEWART
Niagara, Lockport & Ontario Power Company

MANY types of charts have been developed from time to time to solve graphically problems relating to sags in overhead conductors, but none of these methods makes use of alignment or nomographic charts, although such diagrams possess distinct advantages not shared by others. They are simple in form, easy to construct and use and are accurate, since interpolation is made along scales rather than between lines.

If we assume:

p = sag in per cent of length of span for any set of conditions (supports at the same elevation).
R = ratio of resultant force on conductor to weight of wire under the same conditions.
t = temperature in degrees Fahrenheit for the same conditions.
p_o, R_o and t_o = corresponding quantities for any other set of conditions.
L = length of span in feet.

Then if any four of the five quantities p, (RL), p_o, (R_oL) and $(t—t_o)$ are known, two index lines may be drawn and the fifth quantity obtained immediately at the intersection of the proper index line and axis.

A typical problem is worked out below. The solutions are arranged in tabular form to correspond roughly with the way in which the actual solution would be made on the chart. Quantities read from the chart and used in solving the problem are italicized.

A 300,000-circ.mil hard-drawn copper cable is to be strung on an 800-ft. span so that at 0 deg. F., with ½ in. of ice and 8 lb. of wind, the tension in the cable will be 5,000 lb.

Find:

(a) The stringing sag at 60 deg. F.
(b) The sag at 120 deg. F.
(c) The sag at 32 deg. F. with ½ in. of ice and no wind.
(d) The temperature at which the sag of the unloaded cable will be the same as the sag at 32 deg. F. with ½ in. ice and no wind.

From loading tables:

W_r (½ in. ice and 8 lb. wind) = 1.960 lb. ft.
W_r (½ in. ice and no wind) = 1.630 lb. ft.
W (weight of cable alone) = 0.928 lb. ft.

Then:

$$RL\ (\tfrac{1}{2}\text{ in. ice and 8 lb. wind}) = \frac{1.960 \times 800}{0.928} = 1{,}690$$

$$RL\ (\tfrac{1}{2}\text{ in. ice and no wind}) = \frac{1.630 \times 800}{0.928} = 1{,}406$$

$$RL\ (\text{cable alone}) = 800$$

$$p\ (\tfrac{1}{2}\text{ in. ice and 8 lb wind}) = \frac{100 \times 1.960 \times 800}{8 \times 5{,}000} = 3.92 \text{ per cent}$$

	RL	p	$(t-t_o)$
Index line (1)	1,690	3.92	60 deg.
Index line (2)	800	3.87	60 deg.
Index line (3)	800	4.12	

(a) Stringing sag at 60 deg. F. $= \frac{3.87}{100} \times 800 = 30.96$ ft.

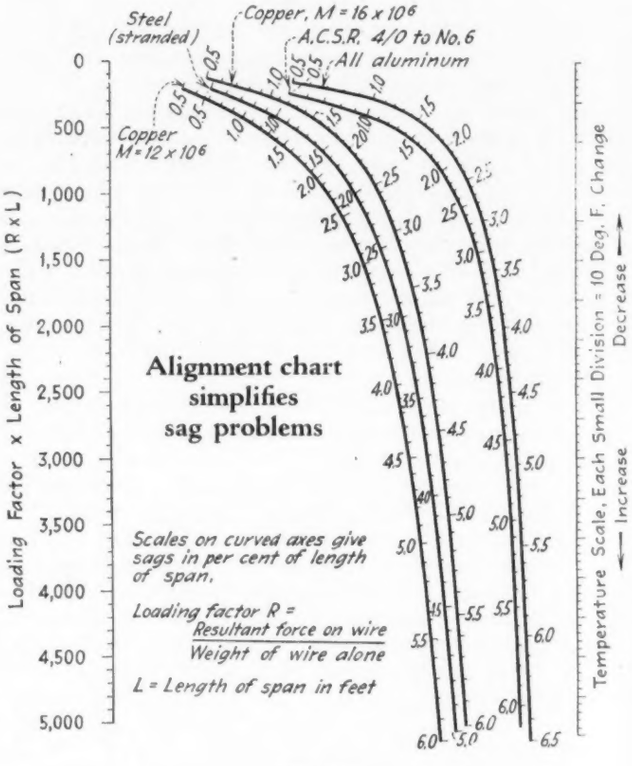
(b) Sag at 120 deg. F. $= \frac{4.12}{100} \times 800 = 32.96$ ft.

	RL	p	$(t-t_o)$
Index line (1)	1,690	3.92	32 deg.
Index line (2)	1,406	3.96	49 deg.
Index line (3)	800	3.96	

(c) Sag at 32 deg. with ½ in. ice and no wind

$$= \frac{3.96}{100} \times 800 = 31.68 \text{ ft.}$$

(d) Same sag in unloaded cable occurs at 81 deg. F.

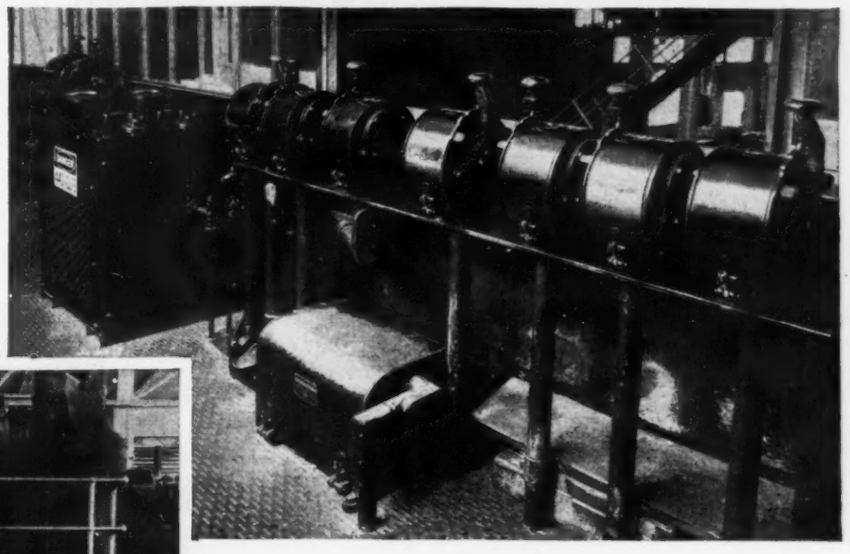

Steel (stranded)
Copper, M = 16 x 10⁶
A.C.S.R. 4/0 to No. 6 All aluminum
Copper M = 12 x 10⁶
Loading Factor x Length of Span (R x L)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Alignment chart simplifies sag problems
Scales on curved axes give sags in per cent of length of span.
Loading factor R = Resultant force on wire / Weight of wire alone
L = Length of span in feet
Temperature Scale, Each Small Division = 10 Deg. F. Change
Decrease
Increase

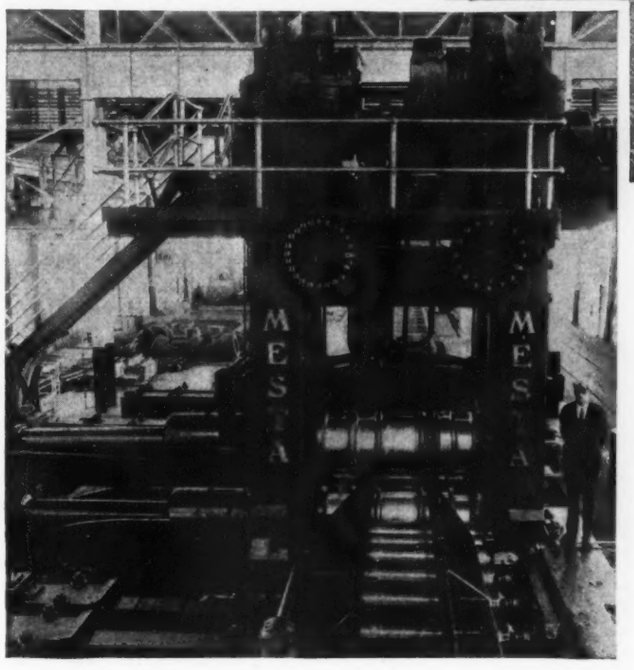
Directions

1. Lay a straight edge on values of RxL and per cent sag corresponding to any known condition of loading and sag and note the point at which the straight edge intersects the temperature scale.
2. Count off from this point along the temperature scale in the proper direction the difference in temperature between the known condition and the condition for which the sag is desired.
3. Lay a straight edge on the point on the temperature scale so located and on the value of RxL applying to the new condition and read the per cent sag at the intersection of the straight edge with the proper curved axis.

Centralized Control Essential to Production Efficiency

By means of these master controllers one operator in the Massena mill of the Aluminum Company of America is able to control the separation, speed and direction of the blooming-mill rolls, while a second operator controls the front and rear table rolls and ingot manipulators. Separation of the rolls is determined by the large dials of the roll frame. Meters above the controls, but not shown, indicate loads on the respective motors.





4,000,000 Hp. in Hydro Plants

HYDRO power development gives promise of continued vigor, even in the eastern part of the country, where reliance must be placed primarily on steam and where the most favorable sites were taken up long ago. No discouraging influence seems to have been exerted by these last two dry years.

The accompanying table of new or prospective developments, announced since the compiling of the list published in the ELECTRICAL WORLD, January 4, 1930, shows nearly 2,000,000 hp. within a radius of, roughly, 1,000 miles of New York City. The total for eastern Canada is even greater.

New or Prospective Hydro Stations Within 1,000 Miles of New York City

Company	Site	Hp.	ELECTRICAL WORLD Reference Date	Page
Mountain Power Co.	Tellico, Tenn.	55,000	July 5, 1930	8
West Penn Power Co.	Allegheny, Pa.	31,000	July 5, 1930	8
Carolina Power & Light Co.	Waterville, N. C.	133,000	Jan. 7, 1928	61
			Aug. 30, 1930	385
Crisp County	Cordele, Ga.	18,200	Jan. 25, 1930	186
General G. & E. (Asso. G. & E.)	Columbia, S. C.	100,500	July 6, 1929	33
Holston River Power Co.	Kingsport, Tenn.	.....	Nov. 19, 1929	33
Holyoke Water Power Co.	Holyoke, Mass.	.....	.....	....
Kentucky-Tenn. Lt. & Pwr. Co.	Barren River	.....	Apr. 12, 1929	724
Kentucky Utilities Co.	Burgin, Ky.	.....	Nov. 23, 1929	1049
New Kanawha Power Co.	Hawks Nest, W. Va.	100,000	Dec. 14, 1929	347
New York Central Elec. Corp.	Lake Keuka, N. Y.	20,000	Sept. 8, 1928	480
New York Power & Light Corp.	Spier Falls, N. Y.	57,000	Apr. 19, 1930	773
Niagara, Lockport & Ont. Pwr. Corp.	Altman, N. Y.	10,000	Apr. 12, 1930	725
Northern Acquisition Company	Michigan	20,000	.....	....
Northern Connecticut Pwr. Co.	Windsor Locks, Conn.	.....	.....	....
Potomac River Corp.	Great Falls	225,000*	July 12, 1930	51
Safe Harbor Water Power Corp.	Susquehanna River	539,000	July 5, 1930	8
			Mar. 29, 1930	625
St. Lawrence County Utilities	Theresa, N. Y.	.....	Oct. 26, 1929	854
Union Carbide & Carbon Corp.	Hawks Nest, W. Va.	.....	June 14, 1930	1193
Virginia Public Service Co.	Natural Well	100,000	Nov. 2, 1929	902
Virginia Public Service Co.	Blandsford	.....	.....	....
W. Va. Power & Transmission Co.	Cheat & Blackwater Rivers.	500,000*	July 12, 1930	56

CANADA

Company	Site	Hp.	ELECTRICAL WORLD Reference Date	Page
City of Montreal	Lachine Rapids	16,000	Feb. 15, 1930	329
Abitibi Power & Paper Co.	63 miles n. of Cochrane	.....	Apr. 19, 1930	771
Canada Northern Power Corp.	Notch	13,000	July 19, 1930	103
Ontario Hydro-Elec. Power	Chats Falls	250,000	Dec. 28, 1929	1292
Ontario Hydro-Elec. Power	Elliott Chute	1,800	.....	....
Ontario Hydro-Elec. Power	Trethewey Falls	2,400	.....	....
Ontario Hydro-Elec. Power	Alexander Falls.	54,000	July 19, 1930	104
Ontario Hydro-Elec. Power	Alexander Landing	72,000	.....	....
Ontario Hydro-Elec. Power	Queenstown	62,000	Sept. 21, 1929	586
Shawinigan Water & Power Co.	Gabelle	30,000	May 17, 1930	962
Shawinigan Water & Power Co.	Rapids Blanc	160,000	July 19, 1930	103
Shawinigan Water & Power Co.	Shawinigan Falls	320,000	.....	....
Shawingian Water & Power Co.	Burroughs Falls	2,000	Aug. 10, 1929	292
Southern Canada Power Co.	Drummondsville	50,000	Mar. 22, 1930	575
Alcoa Power Co.	Chute-a-Caron.	260,000	Sept. 21, 1929	586
Beauharnois Lt., Ht. & Pwr. Co.	St. Lawrence R.	500,000	Aug. 10, 1929	292
Canadian Hydro Elec. Corp., Ltd.	Hawkesbury	40,000	Aug. 3, 1929	248
Gatineau Power Co.	Low	204,000	.....	....
Gatineau Power Co.	Ironsides	72,000	.....	....
Gatineau Power Co.	Bryson	25,000	Sept. 21, 1929	586
Gatineau Power Co.	Chelsea	34,000	Sept. 21, 1929	586
Montreal Island Power Co.	Near Montreal.	12,000	Sept. 21, 1929	586
New Brunswick Power Co.	St. John	7,500†	Nov. 23, 1929	1049
Ontario & Minn. Power Co.	Calm Lake	13,200	Aug. 7, 1929	349

*Kilowatts. †Kilovolt-amperes.

Revamps Factory Distribution Rather Than Reinforce Old

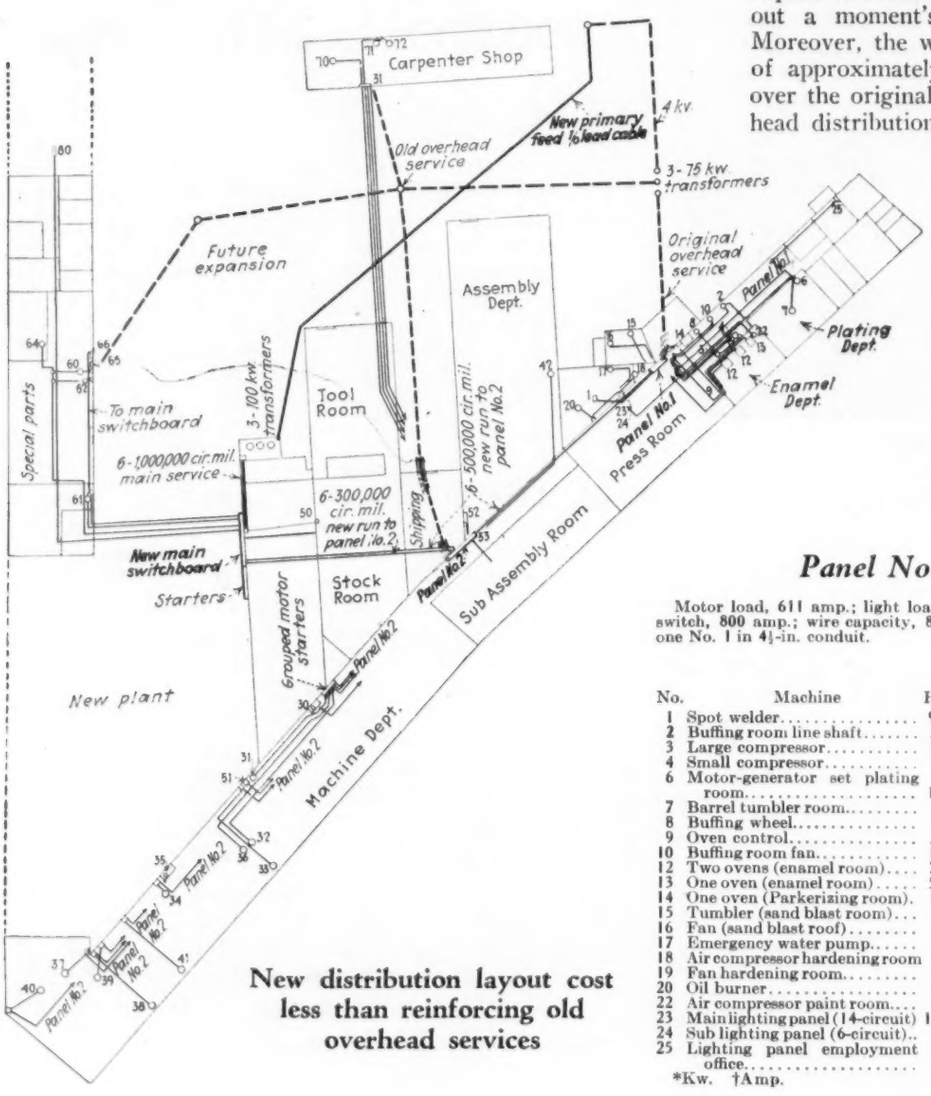
Industrial plant profited by calling in engineer-contractor to revise distribution for enlarged factory

FEELING the need of competent engineering advice to check plans of its own electrician, an industrial plant in California called in an engineering contracting concern to study distribution requirements for expansion of its factory. The result was that the Pacific Electric Motor Company made a complete new distribution layout and put in a job which not only took care of present requirements but the needs of future expansion as well. Overhead service was changed to underground, an entirely new distribution center was established as near the new load center as was physically possible and new sub-distribution centers were established at points of logical motor grouping.

Not only did a much better job result because of the experience of the contractor in handling large jobs and because of his facilities in tools, but improved voltage regulation was obtained, a greater degree of continuity of service was assured, provision was made for future expansion and the entire cutover was made without a moment's interruption on any motor. Moreover, the whole job was done at a saving of approximately 10 per cent to the customer over the original plan to patch up the old overhead distribution system.

The accompanying diagram shows the original system, the layout as proposed by the customer and the installation as finally made.

One of the owners of the contracting firm, feeling that the action of the customer was indicative of a trend to modernize industrial plant distribution, asked the president of the concern why he had called in a consulting engineer. The question brought forth this



New distribution layout cost less than reinforcing old overhead services

Main Switchboard

Motor load, 234 amp.; light load, 340 amp.; switch for panel No. 1, 800 amp; switch for panel No. 2, 600 amp.; feeder wires, six 1,000,000 circ.mil.; two No. 4/0; two 4-in. conduits; wire capacity, 1,300 amp.

No.	Machine	Hp.	Wire Size	Conduit (In.)	Disconnect Switch (Amp.)	Mounting
5	Big Toledo press	7½	3 No. 8	1	60	.....
11	Toledo press	5	3 No. 8	1	60	.....
21	Press room line shaft	10	3 No. 6	1¼	100	.....
43	Tool room line shaft	10	3 No. 6	1¼	100	Overhead
44	Bench lathe	3	3 No. 12	½	30	.....
45	Grinder	1¼	3 No. 12	½	30	.....
46	Blower in heat treat room	1	3 No. 8	¾	30	Overhead
47	Grinder	1¼	3 No. 10	¼	...	Tapped on blower circuit
49	Toledo press	5	3 No. 8	1	60	.....
50	Lighting panel in tool room (10-circuit)	10*	3 No. 6	1¼	60	.....
60	Line shaft	10	3 No. 6	1¼	100	Overhead
61	Air compressor	10	3 No. 6	...	60	.....
62	Motor-generator set	2	3 No. 14	1	30	.....
64	Experimental department	3	3 No. 10	1	30	.....
65	Main lighting panel (16-circuit)	11*	.....	2	100	Panel No. 3
66	Sub lighting panel (10-circuit)	21*	.....	2	200	Panel No. 3
48	Heater fan	5	3 No. 10	¾	60	.....
80	Lighting panel new addition	33*	3 No. 2/0	2	200	.....

*Kw.

Panel No. 1 Press Room

Motor load, 611 amp.; light load, 78 amp.; spare capacity, 111 amp.; main switch, 800 amp.; wire capacity, 800 amp.; feeder wires, six 500,000 circ.mil.; one No. 1 in 4½-in. conduit.

No.	Machine	Hp.	Wire Size	Conduit (In.)	Disconnect Switch (Amp.)	Mounting
1	Spot welder	9††	2 No. 1	1½	100	.....
2	Buffing room line shaft	20	3 No. 2	1½	200	Overhead
3	Large compressor	17	3 No. 2	1½	100	.....
4	Small compressor	15	3 No. 4	1¼	100	.....
6	Motor-generator set plating room	10	3 No. 6	1½	60	.....
7	Barrel tumbler room	1	3 No. 10	¾	30	Overhead
8	Buffing wheel	2	3 No. 14	½		
9	Oven control	..	2 No. 12	½	30	.....
10	Buffing room fan	10	3 No. 4	1½	100	Overhead
12	Two ovens (enamel room)	70†	3 No. 6	1½	100	.....
13	One oven (enamel room)	50†	3 No. 6	1½	60	.....
14	One oven (Parkerizing room)	80†	3 No. 4	1½	100	.....
15	Tumbler (sand blast room)	5	3 No. 10	¾	30	Overhead
16	Fan (sand blast roof)	3	3 No. 12	½	30	Roof
17	Emergency water pump	5	3 No. 10	¾	60	.....
18	Air compressor hardening room	7½	3 No. 10	¾	30	Shelf
19	Fan hardening room	3	3 No. 10	¾	30	Wall
20	Oil burner	½	2 No. 14	½		
22	Air compressor paint room	3	3 No. 10	1	30	
23	Main lighting panel (14-circuit)	11*	.....	..	60	
24	Sub lighting panel (6-circuit)	3*	.....	..	60	Press room sub. panel
25	Lighting panel employment office	3*	3 No. 8	1¼	60	

*Kw. ††Amp.

Panel No. 2 Opposite Sub-Assembly

Motor load, 288 amp.; light load, 174 amp.; spare capacity, 88 amp.; main switch, 600 amp.; wire capacity, 550 amp.; feeder wires, six 300,000 cire.mil.; one No. 3/0 in 3½-in. conduit (use 600-amp. switch from panel No. 1).

No.	Machine	Hp.	Wire Size	Conduit (In.)	Disconnect Switch (Amp.)	Mounting
30	Motor-generator set	7½	3 No. 8	1	60	.....
31	Small drill presses	5	3 No. 8	1	60	Overhead
32	Gear hobber	½	3 No. 8	1	60	Overhead
33	Spindle presses	10	3 No. 6	1¼	100	Overhead
34	Whitney grinder	20	3 No. 6	1¼	100	.....
35	Small motor-generator set	1	.....	..	...	Tapped off Whitney grinder
36	Emery wheel	½	3 No. 8	1	60	.....
37	No. automatics	10	3 No. 6	1¼	100	Overhead
38	So. automatics	10	3 No. 6	1¼	100	Overhead
39	Oil separator	3	3 No. 10	¾	30	.....
40	Automatics	10	3 No. 6	1¼	60	Overhead
41	Miller-Heald and line shaft	10	3 No. 6	1¼	100	Overhead
42	Running-in table	2	3 No. 10	¾	30	.....
51	Lighting panel in machine shop (12-circuit)	12*	3 No. 6	1	60	.....
52	Lighting panel in assembly room (20-circuit)	8*	.....	..	100	Panel No. 2
53	Lighting panel in sub assembly room (18-circuit)	18*	3 No. 6	1¼	100	.....

Kw*

Carpenter Shop

Power switch, 60 amp.; light switch, 30 amp.

No.	Machine	Hp.	Wire Size	Conduit (In.)	Disconnect Switch (Amp.)
70	Saw	3	3 No. 10	¾	60
71	Grinder	1	3 No. 10	¾	
72	Drill press	¼			
73	Lights	2*	.....	..	30

*Kw.

interesting reply: "We recognize that when it comes to a major rewiring job our staff is lacking in the broad experience necessary properly to handle the engineering and installation on a job of this size. We went to your concern because we wanted to avail ourselves of the experience of your engineers in laying out large jobs and the facilities you have for carrying on a large reconstruction job without loss of time to the plant."

▼ ▼ ▼

Outages Reduced on European Lines

EUROPEAN experience of many years with the Petersen arc suppressor for protecting high-tension lines against ground faults has demonstrated its efficacy, according to the *Engineer*.

On one three-phase, 50-cycle line, transmitting more than 300 miles at 22 kv., installation of the Petersen coil reduced the number of interruptions from 183 to 22 for a four-month period.

Observations were also made during 1928 on a 110-kv., three-phase, 50-cycle, double-circuit line with an insulated neutral, and having a total length of 225 miles. Of eight faults to ground without the suppressor only one did not cause interruption, while with a suppressor in use nine faults resulted in only one interruption.

This form of protective gear has been applied to approximately 400 systems with an aggregate length of more than 100,000 miles and at pressures ranging from 2,200 to 220,000 volts, the *Engineer* reports.

Number of Outages Greatly Reduced by Installation of Petersen Coil

	Interruptions	
	Without Coil	With Coil
September	63	7
October	52	7
November	25	6
December	43	2
	183	22

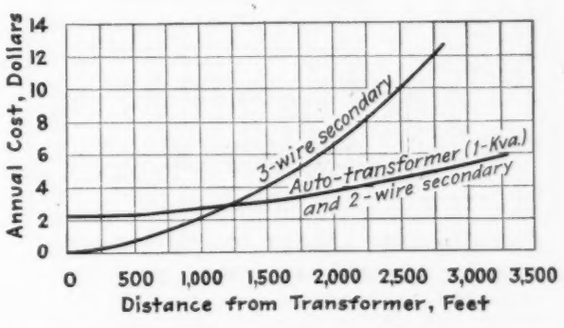
▼ ▼ ▼

Balance Coils Show Economies for Rural Distribution

By R. J. OWENS
Allied Engineers, Inc.

IN RURAL districts, where lighting and range customers are scattered and where it is not practical to obtain a low percentage of unbalanced load on a three-wire secondary, a considerable economy may sometimes be secured by using two-wire, 230-volt secondary lines with balance coils rather than three-wire, 115/230 volt.

Even if all houses are wired three-wire, the individual maximum demand unbalanced load including an electric iron or radiant heater on the end of the secondary must be considered. An average lighting customer should have ample secondary capacity for 550 watts at 115 volts. On a three-wire secondary this unbalanced load requires the same amount of copper as 3.3 kw. at 230 volts, two-wire, which is nearly the requirement of an electric range. Thus 230-volt, two-wire secondaries using balance coils are apparently indicated for long secondary lines.



Comparative costs of copper and auto-transformer for unbalanced load

Standard dry type balance coils or auto-transformers for 220/110 volts are comparatively low in cost and high in efficiency. Balance coils may be mounted on secondary cross-arms. No protective equipment is required. The rating and performance as given by one manufacturer are shown in the accompanying table.

Considering the average requirements for unbalanced load and annual costs of copper, balance coils should not be used less than 1,400 ft. from the line transformer. The saving of neutral conductor alone may be more than the cost of the balance coil, but the gain in capacity for unbalanced load represents six times the saving of neu-

Balance Coil Rating and Performance

Size, Kva.	No-Load Loss, Watts	Full-Load Loss, Watts	Full-Load Regulation, Per Cent	Cost Net, Dollars
1	12	20	2.05	12.00
1½	12	26	1.8	16.00
2	22	35	1.3	20.00
3	28	44	1.2	24.80

tral conductor, neglecting regulation of the balance coil. It is not advocated that secondaries be used on stretches of more than 1,400 ft. between customer or prospects unless they may be used as primaries in case of load development.

Economy may be realized also from the use of 230-volt secondaries and balance coils (1) where it is expensive or impractical to extend primary on account of trees, etc.; (2) where a customer may be allowed to build a private low-voltage line for lighting and small power, or (3) where it is desired to reduce objectionable voltage fluctuations caused by 110-volt, single-phase motors.

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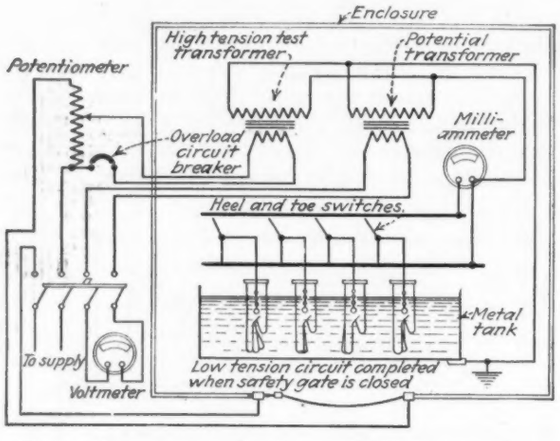
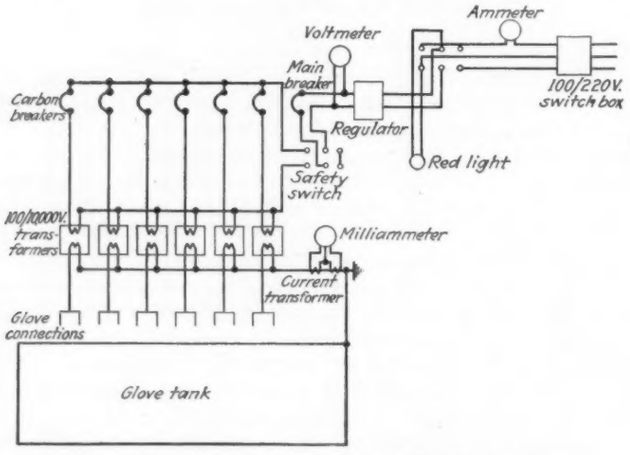
Rubber Glove Test Methods Recommended by N.E.L.A.

TYPICAL installations for the periodic retest of electricians' rubber gloves, as recommended by the meter committee of the National Electric Light Association, are outlined in the accompanying illustrations.



Potentiometer voltage control for testing rubber gloves

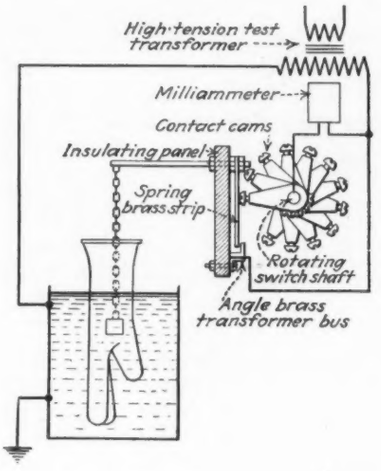
By means of the make-before-break switches manually operated from outside the inclosure the leakage current may be read without interrupting the circuit through the gloves.



Individual transformers for each glove circuit

(Duquesne Light Company)

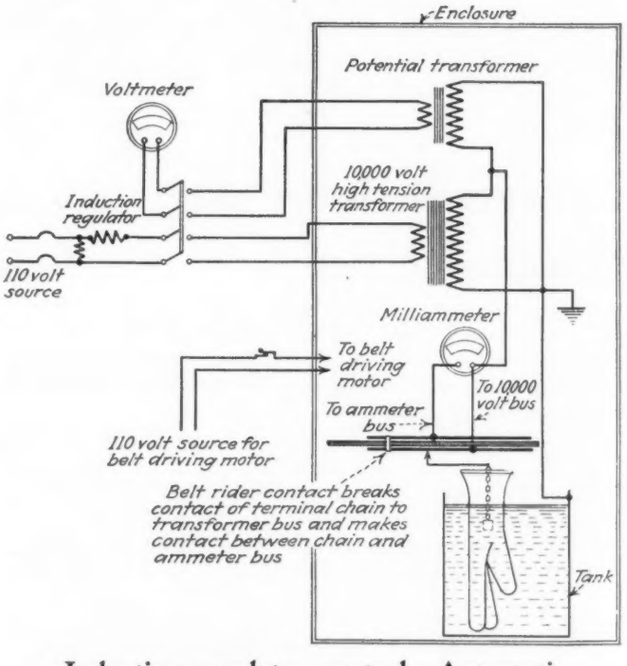
If one glove breaks down, its individual circuit breaker opens and the test continues on the other pairs of gloves. An auto-transformer is used to regulate the voltage; leakage current is measured with current transformer.



Leakage measurement with rotary switch

(Union Gas & Electric Company)

By rotating this switch manually the milliammeter is connected into any one of twelve glove circuits without disturbing voltage applied to gloves.


Enclosure
Potential transformer
Voltmeter
10,000 volt high tension transformer
Induction regulator
110 volt source
Milliammeter
To belt driving motor
To 10000 volt bus
To ammeter bus
110 volt source for belt driving motor
Belt rider contact breaks contact of terminal chain to transformer bus and makes contact between chain and ammeter bus
Tank

Induction regulator control—Automatic leakage measurement

(United Electric Light & Power Company)

Remote control used with belt and rider system provides inherent safety for the tester in that the rider which performs all high-tension switching is mounted on a rubber belt running on grounded pulleys. The operator has only to start and stop the belt-driving motor.

Closer Manufacturer-Contractor Relations*

Kaiden-Keystone Studios.

CONTRACTOR viewpoints and policies are usually, of necessity, local, and those of the manufacturer are necessarily national in scope. Herein lies the germ of misunderstanding and maladjustment.

N.E.M.A. head makes a plea for a mutual understanding and closer relations between the two groups—a co-ordination of the national with the local viewpoints. He proposes machinery for such a rapprochement.

By CLARENCE L. COLLENS

President National Electrical Manufacturers' Association

THAT there has been a difference of opinion between the electrical contractor and the manufacturer on important matters and over long periods cannot be gainsaid, and where these conditions exist there must always exist a reason. In considering what I should say to you today, I have sought for that reason, and for a constructive suggestion as to the remedy.

Whether or not I am correct in my facts or my analysis, I am convinced that much of the difficulty lies in the ever-present enemies to co-ordinated thinking, viz., misunderstanding and misinformation. I feel that if we will each study the other, first as to his physical condition, second as to his mental habit and, third, as to his problems, the knowledge gained must result in co-operative relations on such of those problems as hold common interest.

I am told that the annual volume of electrical contracting approximates $600,000,000, that there are perhaps 20,000 men who would report themselves to a census enumerator as electrical contractors, that probably not more than 5,000 of these would actually so qualify in your opinion, and that while a number of men exceed the amount, the general range of annual business done runs from $50,000 to $250,000.

As to your organization, I am told that you number about 2,100 members and are organized in some 70 local chapters.

These are conditions which differ widely from my own branch of the industry. N.E.M.A. has but 350 members and no local organization. Instead of concentration upon a single activity, the products are so diverse as to require division between some 50 sections. An annual output of $250,000 would tend toward a minimum rather than a maximum average.

But I think the major difference and the one most provocative of misunderstanding lies in the fact that the manufacturer's picture is national, whereas, in the main, a contractor's picture is intensely local.

In large measure the contractor works locally. Local regulations, local inspection, the local utilities' attitude toward this or that must greatly influence his attitude and performance. If the manufacturer could in each instance integrate for himself the conditions in each

**From an address before national convention Association of Electragists.*

locality, and could establish in each locality a policy which directly met those conditions, it is conceivable that there would be more of satisfaction and less of misunderstanding. But no one has yet evolved a practicable method of doing this. To attempt it with the means at hand would probably involve expense which would so increase selling prices as seriously to hamper business with ultimate loss to all concerned.

The national viewpoint of the manufacturer is not a matter of egotism, nor is it even a matter of choice. He must adopt it so that his output shall be sufficiently large to permit of modern economic manufacturing methods. The market will not continue for very long to pay for goods produced by any other means.

Having produced his national output, he must sell it, and this requires a national policy. If carefully determined, this policy will at best meet only the average of all local conditions and, in the degree in which conditions in a given locality depart from the average, dissatisfaction is sure to exist.

The work of a body such as the joint committee on motor merchandising is of large value in determining the average conditions and in adjusting the national plan to them. That the plan so determined would accurately meet all conditions and every one's ideas would, however, be too much to expect, and there is sure to be some disappointment on both sides. The manufacturer's interest lies in making it as universally acceptable as possible and he may be relied upon to work co-operatively and patiently toward that end. The task would be sufficiently difficult if there were but a single manufacturer. It is not simplified by the fact that there are twenty or more, each with his own specific interests and as competitors, each subject to the restraints of the federal anti-trust laws.

Cost a major market factor

It is trite to say that cost is a major factor in distribution—that in the degree in which price can be warrantably decreased the market will widen. But sometimes in considering a specific situation the obvious is disregarded and the ultimate effect of a policy overlooked.

A margin for distribution cost must be provided and that margin divided between co-operating factors. If the difference is narrow between sold cost and the acceptance level necessary to secure a wide market, the percentages available to each handler are narrow and the business is not attractive.

To increase this distributing margin, the manufacturer has put much more effort behind *standardization of products* and *standardization of acceptance conditions.* In the degree in which standard acceptance conditions are attained, the differences in local conditions disappear, and the national plan meets the local requirements, and consequently the needs of the contractor.

I am told—and again you will note that my lack of real personal contact with the contractors' problems obliges me to quote—that there is not a clear understanding by the contractor of the importance to him of standardized acceptance conditions throughout the country; that in some instances there has been actual pride in the formulation of a local code which differed from that of other localities. This seems hardly possible when one considers what it means. Assume that there are 10,000,000 lamp sockets used per year and suppose there were 2,000 localities whose requirements differ through local pride or for other reasons. An average of only 5,000 sockets of a kind could be sold per year, and these divided among twenty manufacturers would make only 250 each. They would cost a dollar or more apiece instead of the present 11 or 12 cents and the higher price would radically reduce installation and the sale of co-acting materials and the work of the contractor in installing both. Only universal acceptance makes possible the present price.

The same is true of every commodity you handle. Difference in acceptance conditions increases the number of types without real gain, increases the cost, narrows both the market and the margin available for distribution and operates directly against your and our interest.

Here is one matter upon which the contractor and the manufacturer should be solidly in agreement—with the forwarding of which they should let nothing interfere. It should be an article of faith to work together to secure simple, uncomplicated enactment and honest enforcement of uniform acceptance and installation conditions throughout the country. The interest of each is vitally promoted thereby, as is the interest of the public, and yet we find difference of opinion on even this fundamental. It can only be due to misunderstanding or misinformation.

The manufacturer is promoting uniformity in acceptance conditions by urging that when municipal ordinances are under consideration the National Electrical Code as approved by the American Standards Association and the National Electrical Safety Code as approved by the American Standards Association and other installation and safety regulations as approved by the American Standards Association shall be *prima facie* evidence of approved methods.

There has been prepared by eminent counsel a model of an ordinance in its simplest form, and if asked how his suggestion may be embodied he presents this as an example. Many ordinances have been adopted which carry his basic suggestions. An allied procedure is used in state statutes.

The code embodied in an ordinance becomes, therefore, the basis for uniformity in acceptance conditions.

Advantages of standardization

Uniformity in acceptance conditions is obviously the foundation for all standardization of products and materials and the resultant cost reductions which permit the necessary distribution margins. Further, it eliminates one major difference in local conditions and tends to make national distribution plans satisfactory to local business men over a vastly wider field.

It is obvious that to standardize would be foolish if the resultant structure is to have only a limited acceptance, and the advantages of standardization are so apparent that it seems unnecessary to enumerate them. But standardization must be orderly, must not be of a nature to prevent the free use of advances in the art, lest stagnation result, and the code must advance as the art makes it possible. A procedure has been evolved after long experience which not only permits but

encourages this progress, and while at times it may appear complicated and slow-moving, it is believed that no more of time or complication is involved than is necessary to assure that the rights and interests of all parties shall be adequately guarded.

I see little possibility of the mutual understanding of the problems which confront us, the consequent solution of those problems or the comprehension of the conditions which render them not wholly solvable even with the utmost of good will on both sides—all of which are major factors in stability—unless there is evolved a method through which closer contact may exist and free discussion eventuate.

How shall we arrange for the necessary continuing interchange of views? If the manufacturer has evolved and has begun to follow a definite policy, how shall the contractor become fully acquainted with that policy and the conditions which lie behind its adoption, and find it good, or criticise is broadly and fairly and intelligently?

Obviously the manufacturer cannot place it before your 70 local chapters by direct contact, and to attempt to transmit it would be futile. It must be considered and opinion transmitted by men who are expert in the conditions which pertain in those localities and whose interests are those of the contractors in those localities. No one but members of your own organization meet this description.

Is not this merely an instance of the difficulties which arise when national and local viewpoints are respectively the major concern of two parties in interest—the difficulty of effectual contact?

It seems to me that you gentlemen must analyze your problems and determine which of your local conditions are sufficiently recurrent throughout your chapters so that they present a national aspect and must then arrange machinery which will permit their consideration. I put this burden on you, not because the manufacturer is unwilling to assume it, but because he cannot possibly organize to carry it. If there could be a local replica of N.E.M.A. in each locality in which you have a chapter, I am quite sure that there would be little of misunderstanding existent, but this is obviously impracticable.

Contact through national headquarters

You can, however, make these contacts with each branch of N.E.M.A.'s activities through your national headquarters if you organize to that end. This may mean something more of staff and it will mean more time spent in committee contacts by some of your members. I realize that by reason of the nature of your business it is by far more difficult for you to carry on committee work than it is for the manufacturer with his larger staff, and that the mere expense of travel is a far larger matter to you than to the manufacturer, with his larger business, but does not this lack of knowledge of the contractor's viewpoint exist because you have not done more of it, and do not your own differences of opinion in matters of national importance result from the lack of it? The viewpoint of the contractor has been called unstable.

I am told that the contractor feels that he is not given due consideration by other branches of the industry, that his value as an industry factor is underestimated and that he is looked upon and treated as a problem rather than a partner in the general scheme of things. This may all be true in some measure, and if it is are the other branches of the industry to blame and how much, or is the contractor to blame and how much? It is practically certain that neither party is 100 per cent right. That does not often happen.

One major difference of condition may be noted: The other three branches of the industry are so organized centrally that they can be in daily authoritative touch on their mutual problems. Are the contractors so organized, and if not, may not this have much to do with setting up the conditions complained of, resulting, as it must, in lack of knowledge on both sides?

I have touched mainly on two subjects which vitally concern the electrical manufacturers and which should be of equal interest to the contractors, namely, the national distribution of a standardized product, which can only be realized if there is national uniformity of local acceptance conditions. But these are not the only subjects of common interest or which justify joint consideration. We are each interested in the elimination of trade abuses, the fostering of better business methods, and any promotional activity which will stimulate sales and educate all branches of the industry and the public which we serve on the advantages of *adequacy* in all electrical installations.

We are both organized in our respective fields. We have each our internal problems, but on matters of vital common interest we cannot exchange viewpoints or promote mutual understanding unless you are so organized that the policies of the manufacturers, which must naturally be national in scope, can be brought home to your 70-odd local chapters and unless the average of your business experiences in these various localities can be adequately placed before the manufacturers by your central organization as justifying national consideration. And there must be realization that not everything will be accomplished in a day, but, with the right set-up and the right contact between the two organizations, time, patience and mutual respect and clear thinking will work wonders.

▼ ▼ ▼

British Report on Road Surface Reflection

STREET lighting and highway illumination is a subject of rapidly increasing importance owing to the continuous growth of fast-moving traffic on the streets and roads of the chief automobile-using countries. Improvement in the design and methods of use of street-lighting fittings must depend to a large extent upon a fuller knowledge of the principles which govern the visibility of objects on a roadway. Among the factors which affect visibility, the brightness of the road surface is one of the most important, and this brightness is a

function not only of the illumination of the road but also of its reflection characteristics.

Little information has been obtainable hitherto on the reflection factors of road surfaces. However, the illumination research committee of the British Department of Scientific and Industrial Research has now made a study of samples which have been in use as part of a road's equipment. The investigation is described in a technical report recently issued by the committee. This report arrives at the conclusion that, owing to the special conditions under which a road surface is illuminated and viewed, the ordinary laws of diffuse reflection not only do not apply but are absolutely valueless as a guide to the relation between the illumination and the brightness of one portion of the roadway. It has been found that where the light falls very obliquely the brightness, especially when the surface is viewed obliquely, is greatly in excess of that which would be obtained by calculation on the assumption of perfect diffusion. In certain cases it is several hundred times as great. For a wet surface, the committee states, the effect is still more marked.

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Mechanical Rectification with Mercury Jet Wave

THE mercury jet-wave rectifier, a new high-capacity power device of a character quite distinct from that of the mercury-arc rectifier, shows promise of furnishing strong competition in the field of direct-current supply, according to J. Hartman* of Copenhagen.

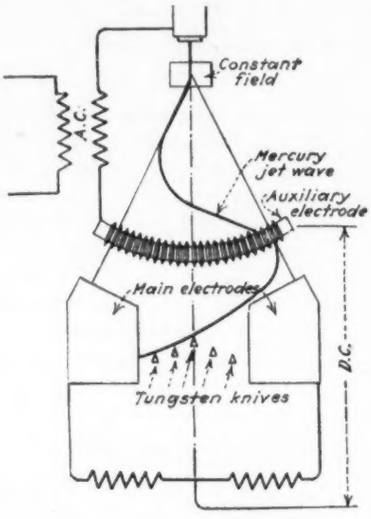
The largest jet-wave rectifier so far constructed is rated at 200 kw. at 550 volts for a street-railway load in Copenhagen and is said to have given complete satisfaction since its installation. None of the rectifiers yet built requires air or water cooling. Short circuits that have put rotary converters out of operation have merely caused these rectifiers to work at greatly reduced voltage, and after the removal of the short circuit normal operation has been restored. Typical efficiency curves for two sizes of rectifiers are shown in the accompanying figure. The 20-kw., 75-volt rectifier is considerably more efficient than the 33.3-kw., 180-volt one.

The jet-wave rectifier is a purely mechanical device to accomplish rectification by means of a moving wave of mercury which, following the oscillations of the impressed alternating-current voltage, alternately makes contact with two electrodes connected to the ends of the secondary windings of a transformer tapped at the midpoint. In this way a circuit connected with the jet and the midpoint of the transformer will receive direct current from the commutator.

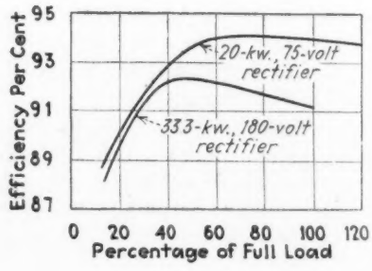
The mercury passes through a constant field obtained by a direct-current magnet coil. An alternating current in phase with the voltage to be rectified is passed through the mercury jet. The resulting interaction of the magnetic fields forms the moving mercury jet into a wave. By interposing electrodes in the path of this moving conductor the jet wave acts as a switch to commutate any alternating voltage.

The mercury wave is cut as it passes from one electrode to the other simultaneously by a number of tungsten knives. This is necessary to eliminate sparking difficulties.

The auxiliary electrode used to tap the wave consists of two cylindrical pieces of steel sharply threaded and bent into an arc. The mercury jet wave passes between these two "currycombs" and the teeth cut a few tenths of a millimeter into it. With this arrangement the jet wave is unimpaired and currents of several hundred amperes can be handled.



Mercury jet-wave rectifier depends on simple mechanical action



Jet-wave rectifiers show high efficiencies

Rectification of multiphase voltages may be effected by using a separate jet rectifier for each phase. The rectifier that has been almost exclusively produced is the six-phase type, which consists of three mercury jet commutators connected to the secondary windings of a three-phase transformer, and the three two-phase rectifiers thus formed are connected in series.

The rectifier does not, of course, work entirely without moving parts. The mercury pump must operate all the time, and in certain cases it is necessary to provide a small generator for the supply of current to the direct current magnet.

No very definite figures are given concerning the cost, although it is believed that it will compare favorably with that of other rectifying equipments. The parts are simple and easily adaptable to mass production. The most expensive material employed in the construction of the jet wave is the mercury. For large rectifiers the amount necessary at present is about 1 lb. per kilowatt.

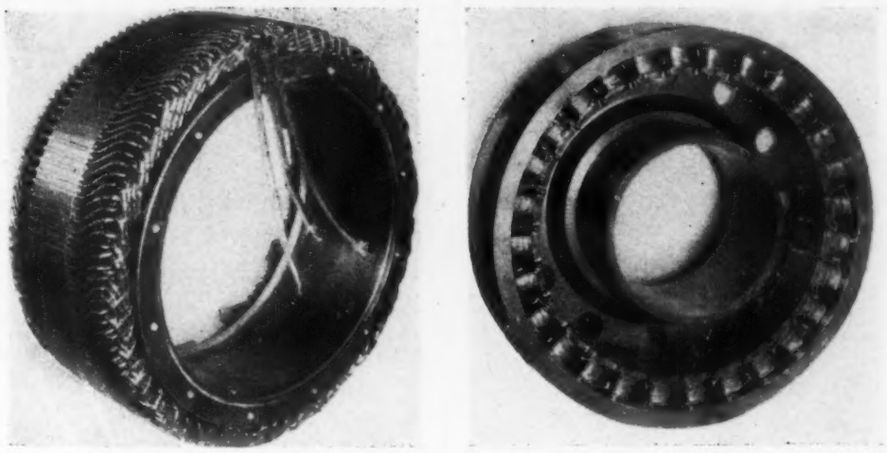
Abstracts of a paper, "The Jet-Wave Rectifier," presented at a recent meeting of the Institution of Electrical Engineers, England.

Synchronous Motors on Gyratory Crushers

APPLICATION of direct-connected synchronous motors to Kennedy-Van Saun gyratory crushers resulted in rather a unique design of the motor. Construction of the motor is now reversed, in that the stator of the motor is on the inside and bolted to the frame of the crusher. The rotor is the usual pulley wheel of this type of crusher, within which is mounted the field poles.

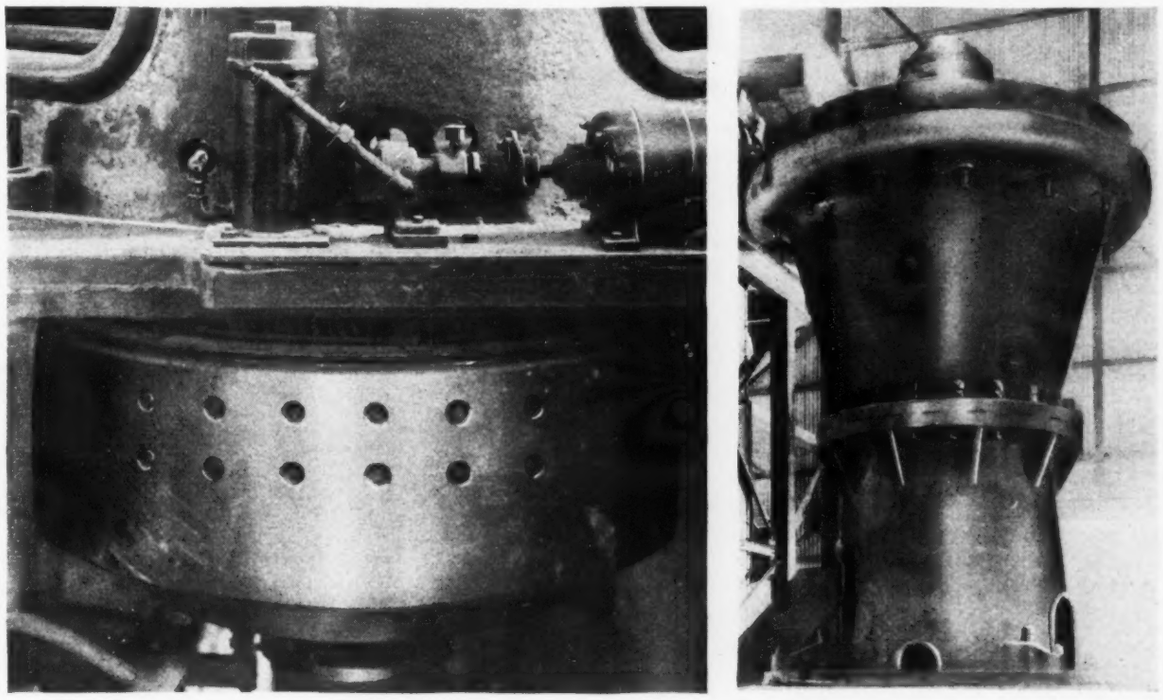
Originally this crusher was driven by means of belted or geared drives. However, low efficiency and high maintenance resulted from these drives. Then, too, the original installation cost of such a drive was high, due to the fact that motor foundations or engine foundations had to be put in. Belt maintenance and motor housing construction were also expensive.

With this new design of synchronous motor, the original pulley with the stator poles inside becomes the rotor and this, connected with the eccentric, rotates the main shaft. The economies resulting from this new design are higher efficiency, less maintenance on motors and bearings, ability to aid in plant power factor correction and lower installation expense. A very compact, highly efficient installation results. The crusher can be belted to an engine if electric power is lacking and it can be operated electrically when power becomes available.



The inside-out synchronous motor

The stator (armature) is bolted to the crusher frame and the rotor (field) connected to the drive shaft of the eccentric gyrator. The outside of the rotor may be used as a pulley for belt drive if necessary.



Direct crusher drive

This Kennedy-Van Saun gyratory crusher, directly driven by a 50-hp. Electric Machinery Manufacturing Company synchronous motor, is in the plant of the Johnson Company, Ltd., Thedford Mines, Province of Quebec, Canada.

The detail view of the motor at the bottom of the crusher shows the striking simplicity of the drive, also the ease with which a belt may be used if mechanical drive is necessary, as in cases where electric power is lacking.

German Electrical Operations

Output of 31,000,000,000 kw.-hr. Installed capacity 12,400,000 kw. Trend toward large interconnected stations. Public ownership favored

NOTWITHSTANDING a slack business year in 1929 German electrical development was very encouraging. The total output gained 10 per cent over the previous year and amounted to 30,700,000,000 kw.-hr. The installed capacity in German electrical plants increased 12 per cent and amounted to 12,400,000 kw. at the end of 1929.

The German utility industry is partly privately owned and operated, partly publicly owned and operated, partly publicly owned and privately operated and partly joint public and private ownership with private operation. In 1929 the publicly owned utilities produced 53.4 per cent of the total output and the trend has been in this direction since 1923.

Brown coal has become the leading power fuel in Germany and in the plants of 100,000 kw. and over 80 per cent of the energy is produced from brown coal, which occurs in abundance in many sections and is frequently found close to the power plants.

The important districts of Germany for the generation of electricity are Rhineland-Westphalia, using bituminous and brown coal and producing 33 per cent of the total output; Saxony-Brandenburg, using brown coal and producing 31 per cent of the total output; southern Germany hydro-electric plants, producing 16 per cent of the total output, and small scattered utilities aggregating 20 per cent of the total output. In common with

Rating and Output of German Electric Plants

	Public Works				Private Works			
	Rating		Output		Rating		Output	
Year	Generator Rating, 1,000 Kw.	Per Cent Increase Over Previous Year	Million Kw.-Hr.	Per Cent Increase	Generator Rating, 1,000 Kw.	Per Cent Increase	Million Kw.-Hr.	Per Cent Increase
1926	5,171	....	10,208	3.0	4,384	....	11,010	5.7
1927	5,728	10.8	12,317	20.6	4,515	3.0	12,818	16.4
1928	6,297	9.5	14,146	14.8	4,805	6.4	13,725	7.1
1929	7,495	19.0	16,391	15.9	4,921	2.4	14,269	4.3

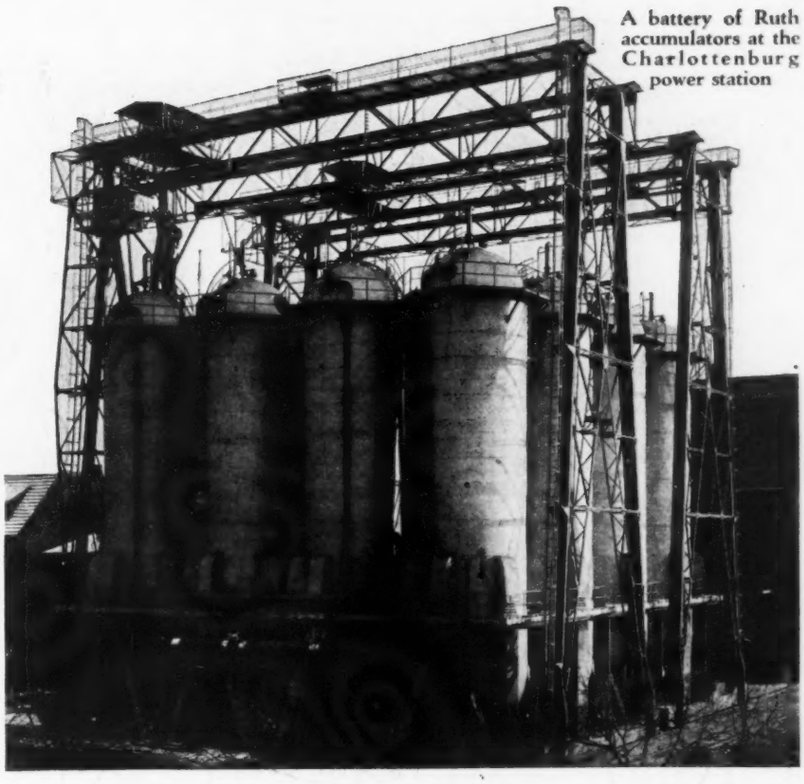
Grouping of Public and Private Germa

Districts and States	Output														
	No. of Plants	Rating, Kw.	Solid Fuel	Water Power	Other Sources	No. of Plants	Rating, Kw.	Solid Fuel	Water Power	Other Sources	No. of Plants	Rating, Kw.	Solid Fuel	Water Power	Other Sources
	Size up to 100 Kw.					From 101 to 1,000 Kw.					From 1,001 to 5,000 Kw.				
Public Works															
Brandenburg including Berlin	5	309	19	52	137	25	9,216	2,637	7,042	3,863	10	25,171	18,204	5,050	3,0
Saxony	15	764	15	149	576	35	10,7c0	3,537	6,844	5,151	8	20,320	9,152	325	1,4
Hanover	30	1,494	128	504	783	39	14,882	2,862	11,997	7,902	7	16,470	13,972	17,563	2
Westphalia	9	582	82	235	163	29	11,189	6,590	9,593	1,081	10	18,282	5,692	32,237	1,1
Rhineland*	17	730	6	891	146	18	5,738	.....	7,603	1,814	8	16,398	23,154	5,380	1,8
Other districts	63	3,335	671	3,294	1,087	120	42,290	8,453	38,641	19,166	35	76,539	25,777	119,023	1,2
Total for Prussia	139	7,214	921	5,125	2,892	266	94,075	24,079	81,702	38,977	78	173,180	95,951	179,578	9,3
Bavaria	206	9,536	257	10,674	2,454	156	48,170	1,769	76,850	12,210	37	82,297	5,142	239,339	8,2
Saxony	6	391	78	549	45	28	12,850	1,676	7,742	1,581	21	49,782	49,440	17,175	1,3
Württemberg	58	3,052	64	5,940	414	64	24,188	288	34,393	6,068	21	42,984	2,630	83,380	5,3
Baden	33	1,977	3	3,113	361	43	16,742	1,380	32,523	1,729	9	17,866	14,494	5,441	3,5
Other states†	57	3,223	110	2,645	1,316	66	19,561	3,181	11,295	6,344	17	43,529	40,990	6,074	8,1
Total for Germany	499	25,393	1,433	27,956	7,482	623	215,586	32,373	244,505	66,909	183	409,638	208,647	530,987	36,2
Private Works															
Brandenburg, including Berlin	158	6,453	6,591	281	1,277	141	47,855	71,901	1,164	11,175	33	66,903	136,705	.....	2,9
Saxony	148	6,970	7,015	1,263	755	113	43,376	61,244	2,953	3,418	44	96,329	240,891	4,863	5
Hanover	121	5,452	4,675	1,697	1,051	119	40,091	55,546	6,377	6,938	29	67,668	99,172	.....	14,3
Westphalia	163	7,387	7,470	1,627	1,917	128	41,231	48,192	11,090	17,037	67	179,051	338,237	6,203	103,3
Rhineland	238	11,977	13,403	1,734	1,564	233	76,606	122,829	11,331	8,217	63	163,240	378,697	10,666	84,9
Other districts*	437	17,205	15,572	3,153	3,546	296	92,082	112,608	24,854	10,613	58	140,927	324,117	9,594	21,2
Total for Prussia	1,265	55,444	54,726	9,755	10,110	1,030	341,241	472,320	57,769	57,398	294	714,118	1,517,819	31,326	227,8
Bayerin	532	18,532	11,819	13,208	3,098	226	69,685	83,953	41,371	6,535	34	77,579	99,602	102,441	27,6
Saxony	482	20,219	17,696	4,394	2,981	34	100,057	146,498	14,764	7,920	56	129,251	313,959	10,967	10,2
Württemberg	190	9,217	6,166	4,895	1,591	119	39,586	34,837	27,154	4,907	15	33,209	51,961	12,011	2,2
Baden	130	5,868	2,522	4,737	1,159	109	33,386	31,457	27,335	5,092	13	32,961	72,437	4,333	4
Other states†	296	13,140	9,649	2,002	3,352	221	64,992	79,260	11,201	16,072	56	119,769	207,280	1,637	90,6
Total for Germany	2,895	122,420	102,578	38,991	22,291	2,046	648,947	848,325	179,594	97,924	468	1,106,887	2,263,058	162,715	359,0

*Ostpreussen, Pommern, Grenzmark, Posen-Westpreussen, Niederschlesien, Oberschlesien, Schleswig-Holstein, Hessen-Nassau, Hohenzollern. †Thüringen, Hessen, Hamburg, Schaumburg-Lippe.

By L. W. W. MORROW

Editor ELECTRICAL WORLD



A battery of Ruth accumulators at the Charlottenburg power station

other countries, Germany has planned an extensive interconnected transmission system and the full utilization of her brown coal and hydro possibilities. Imports exceed exports of energy and more than half of the imported energy comes from Switzerland.

Some of the large utilities of Germany may be mentioned to show the scale of present utility enterprise:

Rhine-Westphalia Electric Power Corporation. — Area served, 17,500 square miles, the greatest part of which is intensely industrialized; population, 10,700,000; gross earnings in 1929, $35,609,037; 1929 sales were 2,067,000,000 kw.-hr.; installed capacity, 1,240,000 hp.; principal station, Goldenberg, 680,000 hp.; 220,000-volt transmission; German replacement value of physical property, over $172,000,000; majority of stock held by governments and municipalities; managed by private enterprise; both bonds and common stock widely held in the United States.

Electrowerke A. G.—Generating capacity 730,000 kw.; population served, 20,000,000; capital stock, about $22,500,000; bonds, $12,500,000; fixed assets, $42,750,000; lignite fuel used and 100 kv. transmission; principal power plants Golpa-Zschornewitz, Lauta and Trattendorf; owned by German federal government.

Berlin Stadtische Elektrizitätswerke (Bewag).—Purchase value about $112,500,000; owned by city of Berlin; generating capacity of seven brown coal stations, 643,550 kw.; 100 kv. transmission; chief stations, Klingenburg, 270,000 kw.; West, 228,000 kw.; Charlottenburg, 104,000 kw.; Moabit, 81,400 kw.; Rummelsburg, 79,600 kw.; Spandau, 56,000 kw., and Obserspree, 44,450 kw.; 850,000 low-tension and 700 high-tension customers; power generated, 1,118,167,463 kw.-hr.; power purchased, 429,333,335 kw.-hr.

Saxon Public Works. — Area supplied, 6,950 square miles; population served, 5,000,000; generation in 1929, 917,000,000 kw.-hr.; 600,000 customers; owns 83,000 acres which are underlain by 3,700,000,000 tons of brown coal; generating capacity, 535,000 hp.; chief stations, Hirschfelde, 195,000 hp.; Boehlen, 281,000 hp.; Niederwartha, hydro, 93,000 hp.; secondary steam stations, 42,000 hp.; 3,573 miles of transmission and distribution; German replacement value of physical property over $95,000,000; owned by the Free State of Saxony. Financed largely by dollar bond issues in the United States.

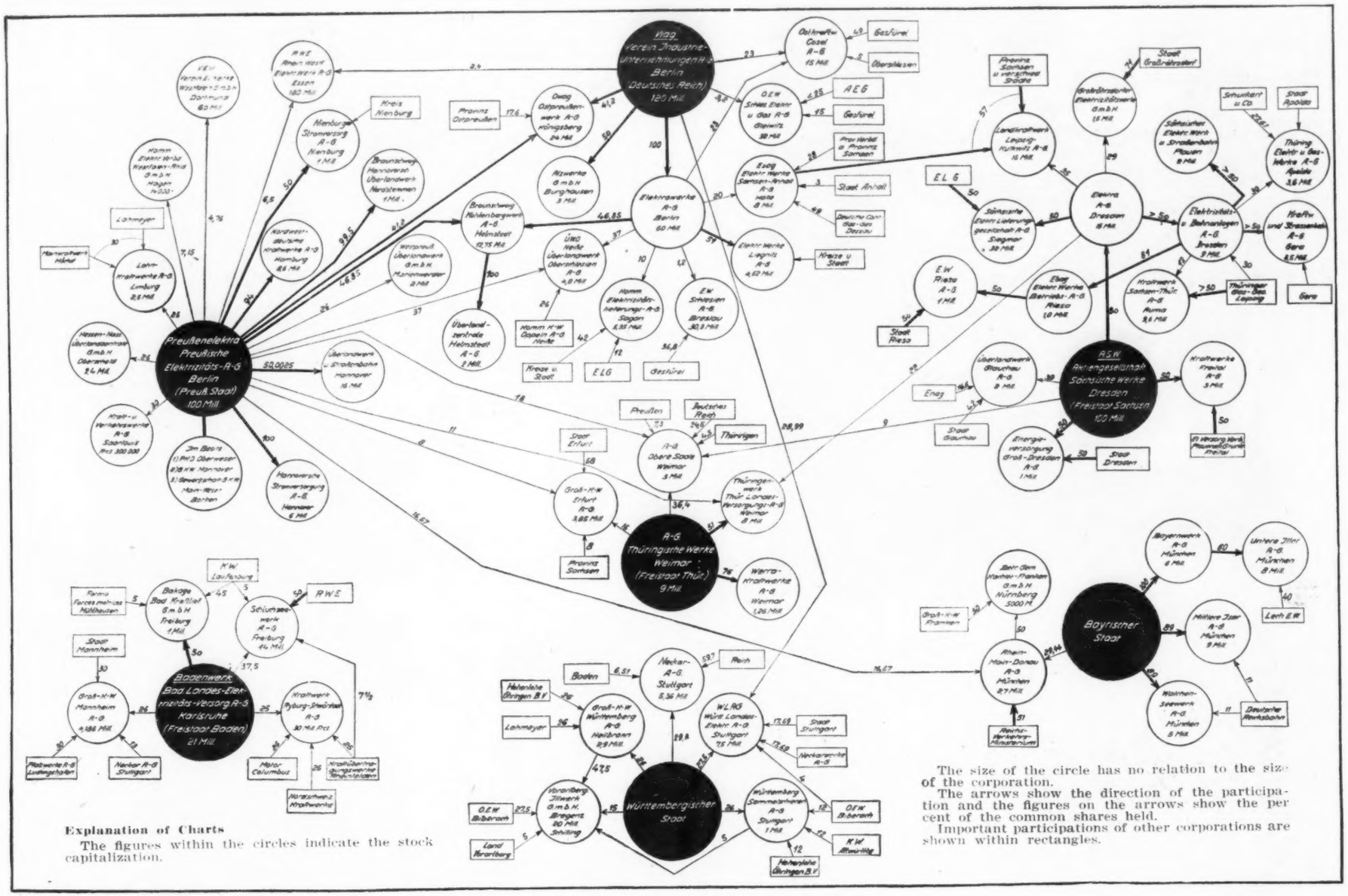
Several other large utilities exist in Germany and the important units are municipally or state owned and controlled. All the major systems have territories allocated to them and are interconnected with neighboring utilities. A gradual taking over of local distributing companies is under way and the

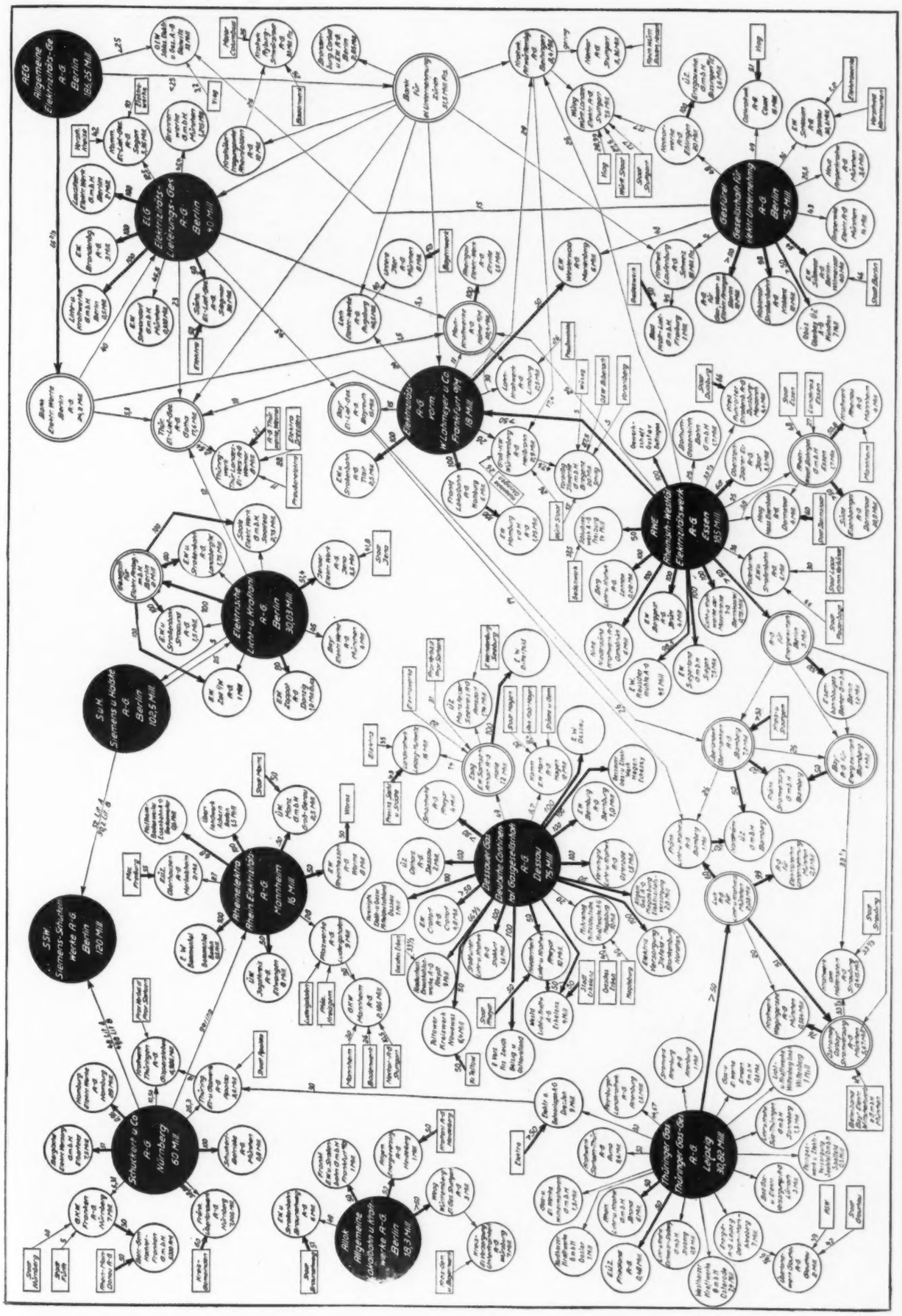
(Continued on page 533)

Utility Stations by Size and Region

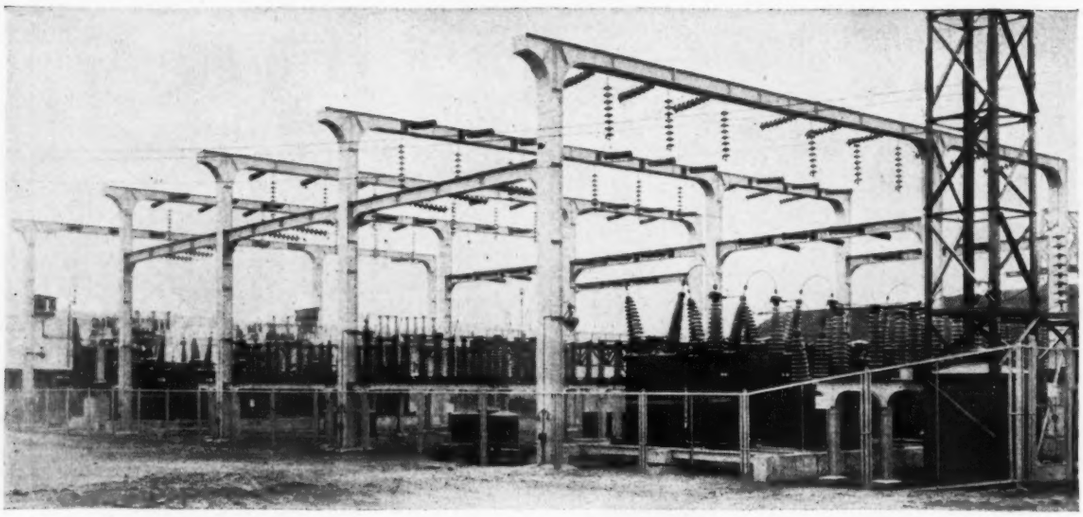
Output									
No. of Plants	Rating, Kw.	Solid Fuel	Water Power	Other Sources	No. of Plants	Rating, Kw.	Solid Fuel	Water Power	Other Sources
From 5,001 to 10,000 Kw.					Over 10,000 Kw.				
5	30,846	30,357	.....	.....	16	1,277,895	2,584,845	.....	1,975
4	27,540	29,029	139	379	8	656,555	1,830,804	.....	.....
1	6,600	.....	.....	.....	7	168,425	353,794	.....	.....
2	15,010	9,260	10,920	.....	11	447,930	910,878	.....	.....
6	44,000	78,393	5,137	.....	20	137,525	3,135,781	15,376	.....
4	29,760	9,123	31,850	.....	26	881,639	1,835,442	43,663	.....
22	153,756	156,162	48,046	379	88	4,569,969	10,651,544	59,039	1,975
4	26,920	41,842	24,266	.....	17	530,350	243,458	841,723	.....
3	22,980	13,386	11,814	.....	16	664,704	1,315,751	369	.....
4	30,600	20,298	50,774	.....	6	136,180	158,128	68,425	.....
4	30,200	3,516	115,092	.....	5	182,250	227,631	229,164	14
4	28,225	19,989	33,153	5,994	10	467,985	831,712	.....	22,035
41	292,681	255,193	283,145	6,373	142	6,551,438	13,428,224	1,198,720	24,024
9	65,580	115,412	.....	3,629	2	39,300	104,248	.....	.....
9	52,637	156,650	.....	35,300	17	498,085	1,997,594	.....	39,900
4	24,228	16,872	5,248	64,926	3	66,750	40,345	.....	165 922
28	182,266	412,707	2,987	77,935	27	519,990	858,851	.....	848,716
23	153,949	323,013	5,000	181,599	28	704,576	895,266	.....	1,346,002
17	133,220	311,905	.....	47,901	7	178,330	572,202	.....	5,357
90	611,880	1,336,559	13,235	411,290	84	2,007,031	4,468,506	.....	2,405,897
7	49,911	48,416	56,963	17,191	5	219,580	224,800	795,182	50,400
6	42,821	97,131	.....	.....	2	30,940	79,461	45	.....
...	.....	.....	.....	.....	...	.....	.....	.....	.....
1	6,200	.....	.....	.....	...	.....	.....	.....	.....
5	37,180	43,962	.....	10,953	3	37,540	102,775	.....	
109	747,992	1,526,068	70,198	439,434	94	2,295,091	4,875,542	795,227	2,456,257

Mecklenburg-Schwerin, Oldenburg, Braunschweig, Anhalt, Bremen, Lippe, Lubeck, Mecklenburg-Strelitz,

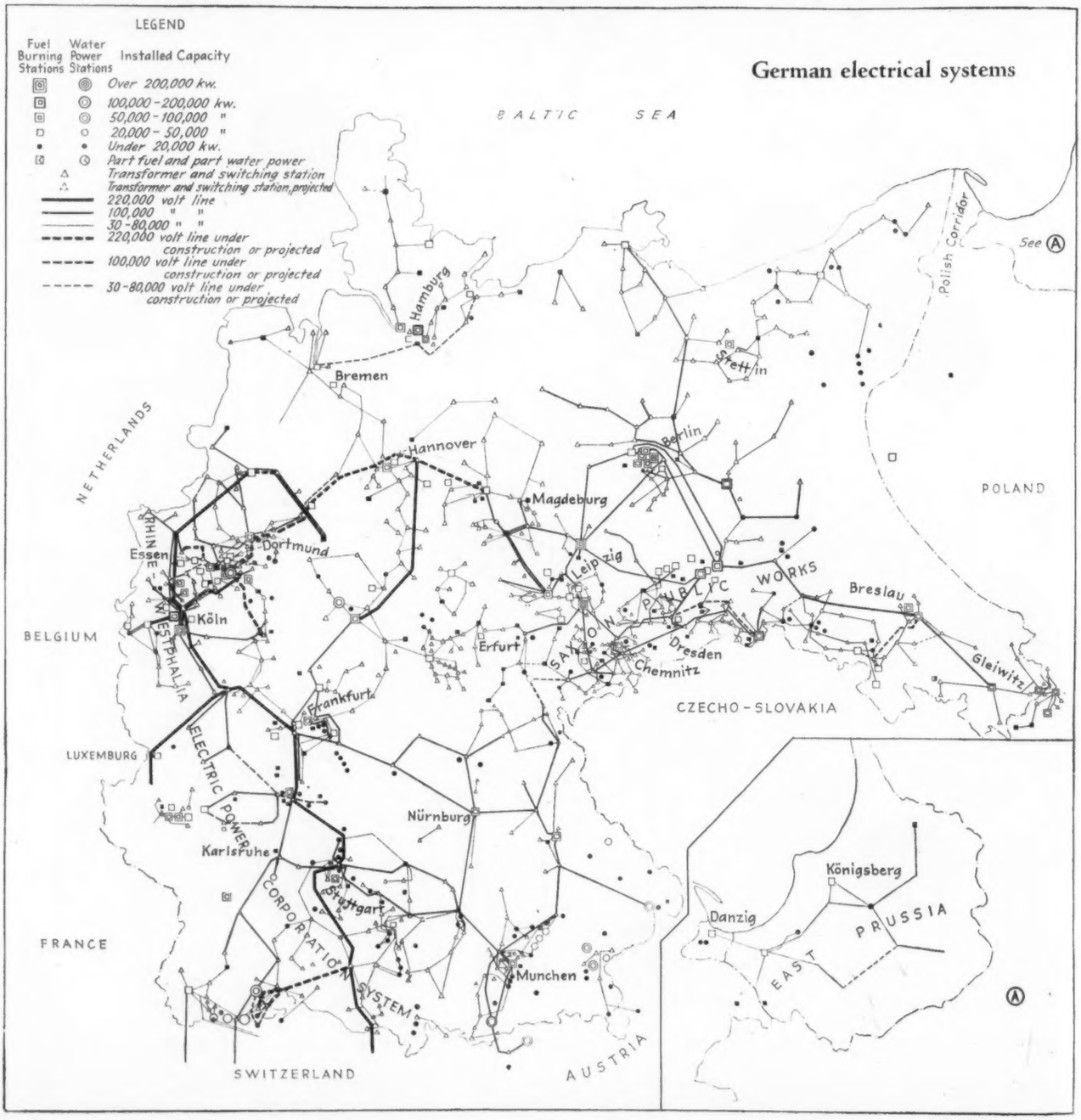

Preußenelektra
Preußische Elektrizitäts-A-G.
Berlin
(Preuß. Staat)
100 Mill.
Vereinigte Industrie-Unternehmungen A-G
Berlin
(Deutsches Reich)
120 Mill.
Elektrowerke A-G
Berlin
60 Mill.
Thüringische Werke
Weimar
(Freistaat Thür.)
9 Mill.
Bayerischer Staat
Württembergischer Staat
Badenwerk
Bad. Landes-Elektrizitäts-Versorg. A-G
Karlsruhe
(Freistaat Baden)
21 Mill.
A.S.W.
Aktiengesellschaft Sächsische Werke
Dresden
(Freistaat Sachsen)
100 Mill.
Elektra
A-G
Dresden
18 Mill.
Elektrizitäts- u. Bahnanlagen
A-G
Dresden
9 Mill.
Land-Kraftwerk
Leipzig-Hirschfelde A-G
16 Mill.
Sächsische Elektr. Lieferungsgesellschaft A-G
Siegmar
30 Mill.
Elektr. Werke
Lagnitz
A-G
4,62 Mill.
Elektr. Werke
Bernsdorf A-G
Riesa
1,6 Mill.
Kraftwerk
Sachsen-Thür.
A-G
Ruma
8,6 Mill.
Thüringer Elektr. u. Gas-Werke A-G
Apolda
3,6 Mill.
Kraftw. und Straßenbahn A-G
Gera
8,5 Mill.
Thüringer Gas-Ges.
Leipzig
Gera
Elektrizitäts-Werk u. Straßenbahn
Plauen
8 Mill.
Großräschener Elektrizitätswerke
G.m.b.H.
1,6 Mill.
Staat Großräschen
Staat Apolda
Schuckert u. Co.
Staat Anhalt
Preuß. Staat u. vereinigte Staaten
Preuß. Staat
Deutsches Reich
Thüringen
Staat Erfurt
Staat Mannheim
Staat Dresden
Staat Plauen
Staat Chemnitz
Staat Stuttgart
Staat Württemberg
Staat Bayern
Staat Augsburg
Staat Nürnberg
Staat Ansbach
Staat Bayreuth
Staat Würzburg
Staat Aschaffenburg
Staat Speyer
Staat Zweibrücken
Staat Landau
Staat Neustadt
Staat Kaiserslautern
Staat Pirmasens
Staat Ludwigshafen



German privately owned utility organizations



Outdoor substation at Moabit power station



Output of German Public Electrical Plants by Districts and States—1929

Districts and States	Generator Rating, Kw.	Total Kw.-Hr.	Solid Fuel, Kw.-Hr.	Output in 1,000 Kw.-Hr. Coal	Brown Coal Briquettes	Brown Coal and Peet	Mixed Fuel	Water Power	Oil	Gas	Other Sources
Ostpreussen	84,042	139,046	104,930	104,010	.....	920	.....	28,723	4,369	964	60
Stadt Berlin	829,545	1,262,700	1,262,700	1,262,700	.....	.....	.....	.....	.....	.....	.....
Brandenburg	513,892	1,394,530	1,373,362	44,258	4,011	1,325,093	.....	12,126	8,440	602	.....
Pommern	140,766	247,283	202,577	202,577	.....	.....	.....	42,733	1,503	470	.....
Grenzmark Posen-Westpreussen	12,659	24,688	16,398	11,723	.....	4,675	.....	8,230	60	.....	.....
Niederschlesien	260,531	533,711	446,306	422,132	530	23,644	.....	84,811	1,945	649	.....
Oberschlesien	87,759	315,322	311,534	311,486	.....	.....	48	3,450	326	12	.....
Saxony	715,939	1,887,595	1,872,537	9,283	71,185	1,788,110	3,959	7,457	7,349	231	21
Schleswig-Holstein	173,338	264,743	250,950	174,806	10,836	.....	63,308	4,857	8,375	547	14
Hanover	207,871	449,272	409,987	326,886	35	82,635	431	30,064	7,828	1,343	50
Westphalia	492,993	987,892	932,502	932,462	40	.....	.....	52,985	2,383	22	.....
Hessen-Nassau*	273,609	611,519	546,771	181,871	2,365	362,020	515	62,741	1,770	327	.....
Rhineland	1,204,391	3,275,563	3,237,334	717,389	.....	2,517,713	2,232	34,387	2,713	1,128	1
Hohenzollern	859	1,133	.....	.....	.....	.....	.....	926	207	.....	.....
Prussia*	4,998,194	11,394,997	10,967,888	4,701,583	89,002	6,104,810	72,493	373,490	47,268	6,205	146
Bavaria	697,273	1,508,197	292,468	151,342	97	126,029	15,000	1,192,852	21,299	1,442	136
Saxony	750,707	1,421,039	1,380,331	109,513	145,050	1,068,730	57,038	37,559	2,428	721	.....
Württemberg	237,004	436,186	181,408	181,394	.....	.....	14	242,912	9,344	2,122	400
Baden	249,035	638,036	247,024	241,691	.....	.....	5,333	385,333	5,053	154	472
Thüringen	59,335	72,228	62,948	17,955	35,751	8,575	667	6,707	2,571	2	.....
Hessen	76,237	144,710	139,346	79,182	23,544	36,620	.....	4,496	838	30	.....
Hamburg	256,030	484,019	479,695	479,695	.....	.....	.....	.....	4,324	.....	.....
Mecklenburg-Schwerin	28,814	45,799	27,357	27,232	125	.....	.....	5,761	12,575	106	.....
Oldenburg	11,294	12,141	9,205	9,110	.....	75	20	1,716	1,220	.....	.....
Braunschweig	32,431	55,347	52,257	389	.....	51,868	.....	2,304	647	55	84
Anhalt	1,696	1,478	40	.....	.....	40	.....	.....	1,356	82	.....
Bremen, Lübeck	93,960	174,159	124,597	124,597	.....	.....	.....	31,684	1,098	16,780	.....
Mecklenburg-Strelitz	732	1,028	377	377	.....	.....	.....	265	386	.....	.....
Lippe, Schaumburg-Lippe	1,994	2,111	160	160	.....	.....	.....	234	1,397	320	.....
Deutsches Reich	7,494,736	16,391,475	13,965,101	6,124,220	293,569	7,396,747	150,565	2,285,313	111,804	28,019	1,238

*Including Waldeck.

entire electrical development is along lines that conform to a national plan of electrification. The accompanying tables show the important statistical facts about the German electrical industry in 1929.

The electrical market in Germany has only been scratched and all utilities are looking forward to increased business. In some measure each is attempting to sell through organized commercial effort to both homes and industries and notable success has been had in this work, particularly by the Rhine-Westphalia Corporation and Saxon Public Works. German industrial plants as a rule generate their own energy and sales are difficult, because industry prefers to use its own equipment rather than to pay out cash to the utility. Both domestic lighting and street lighting offer great opportunities for new business and the manufacture and distribution of appliances for home use is on an inferior scale of efficiency. There is little doubt that the next few years will witness a rapid expansion in the German electrical business.

Average Yearly Hours' Use of German Publicly Owned Stations

Fuel	Rating, 1,000 Kw.	Output, Million Kw.-Hr.	Average Hours' Use
Coal	2,916	5,140	1,762
Brown coal	1,623	5,300	3,266
Oil	68	41	603
Mixed fuel	991	1,629	1,644
Water power	719	2,036	2,831
Total	6,297	14,146	2,246

Output of German Private Electrical Plants by Districts and States—1929

Districts and States	Generator Rating, Kw.	Total Kw.-Hr.	Solid Fuel, Kw.-Hr.	Output in 1,000 Kw.-Hr. Coal	Brown Coal Briquettes	Brown Coal and Peet	Mixed Fuel	Water Power	Oil	Gas	Other Sources
Ostpreussen	43,795	116,600	103,894	103,894	.....	.....	.....	8,870	1,586	30	2,220
Stadt Berlin	53,318	77,419	63,728	58,408	4,820	6	494	.....	11,921	7	1,763
Brandenburg	172,773	377,904	371,129	56,882	6,220	307,755	272	1,445	730	521	4,079
Pommern	57,853	202,717	193,864	193,598	249	.....	17	5,244	438	1,919	1,252
Grenzmark Posen-Westpreussen	407	603	311	20	.....	291	.....	.....	2	.....	290
Niederschlesien	160,729	331,882	307,157	182,725	796	117,702	4,934	12,228	2,341	8,892	1,264
Oberschlesien	154,035	506,905	444,843	444,843	.....	.....	.....	1,141	381	50,175	10,365
Saxony	697,397	2,552,397	2,463,394	11,586	6,919	2,428,142	19,747	9,079	4,032	75,224	668
Schleswig-Holstein	46,741	103,578	99,610	99,607	3	.....	.....	175	9,640	240,320	3,430
Westphalia	929,925	2,736,532	1,665,457	1,651,082	857	174	13,344	21,907	6,626	927,857	114,685
Hessen-Nassau*	96,494	198,340	186,499	120,921	1,265	51,401	12,912	8,417	1,425	549	1,450
Rhineland	1,110,348	3,384,302	1,733,208	1,101,450	89,714	535,127	6,917	28,731	10,019	1,506,527	105,817
Hohenzollern	1,710	2,091	226	128	.....	.....	98	1,526	339	.....	.....
Prussia*	3,729,714	11,074,592	7,849,930	4,216,212	109,825	3,463,933	59,960	112,085	52,835	2,812,106	247,636
Bavaria	435,287	1,582,657	468,590	378,398	16,361	63,941	9,890	1,009,165	16,514	86,737	1,651
Saxony	323,288	706,017	654,745	139,082	123,576	256,576	135,511	30,170	10,531	6,353	4,218
Württemberg	82,012	145,799	92,964	90,327	1,731	429	477	44,060	6,028	5	2,742
Baden	78,415	181,541	106,416	103,751	1,383	.....	1,282	68,448	2,991	478	3,208
Thüringen	102,275	196,473	159,074	11,405	24,189	107,840	15,640	9,587	5,964	16,791	5,057
Hessen	52,564	102,477	96,271	89,740	225	6,306	.....	502	1,991	3,416	297
Hamburg	13,998	33,190	17,251	16,870	.....	.....	381	.....	7,051	8,857	31
Mecklenburg-Schwerin	10,645	20,577	18,122	17,994	.....	.....	128	1,089	548	29	879
Oldenburg	12,199	14,914	13,501	11,573	.....	1,905	23	5	912	285	211
Braunschweig	32,757	76,599	61,356	5,591	1,487	53,697	581	2,103	994	8,999	3,148
Anhalt	19,230	47,017	43,270	35	87	43,148	.....	1,550	179	.....	2,018
Bremen, Lübeck	13,785	57,353	4,718	4,620	.....	.....	98	.....	699	51,003	933
Mecklenburg-Strelitz	244	272	30	30	.....	.....	.....	.....	80	7	155
Lippe, Schaumburg-Lippe	14,924	29,875	29,333	28,713	.....	.....	620	4	8	.....	530
Deutsches Reich	4,921,337	14,269,353	9,615,571	5,114,341	278,864	1,997,775	224,591	1,278,768	107,235	2,995,066	272,7311

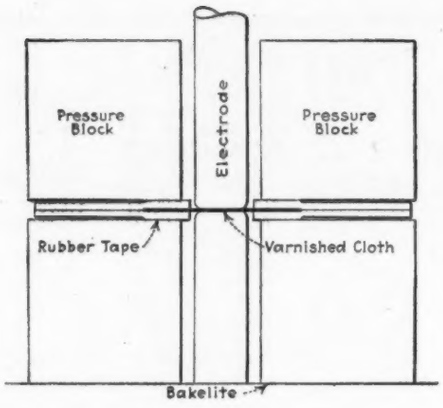
*Including Waldeck.

New Method for Testing Varnished Cloth Tape

By WARREN MASTER
Assistant Engineer Research Bureau, Brooklyn Edison Company

A NEW method of preparing varnished cloth tape for dielectric strength tests and having none of the drawbacks of previous methods has recently been developed in the research bureau laboratory of the Brooklyn Edison Company.

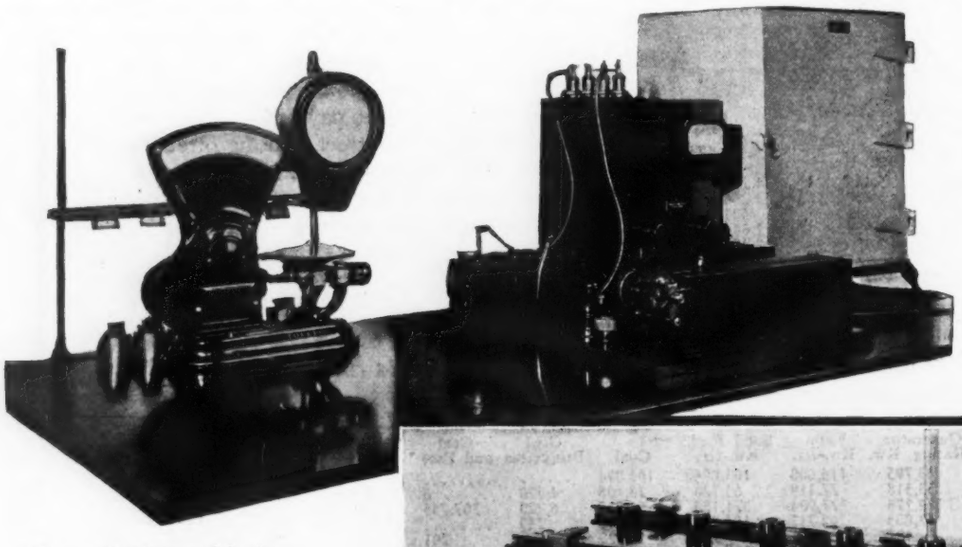
The problem of sealing the edges of narrow tapes against flashover has been solved without the use of materials detrimental to the varnish film, and which often have a tendency to creep under the electrodes, or resorting to the tedious process of cementing cloth tapes along the edges of the specimen to increase its width. Nearly 100 per cent satisfactory tests have been obtained on tapes having dielectric strengths up to 25,000 volts by the use of rubber splicing compounds (ordinary rubber tape) applied as shown on the accompanying diagram.



Method of testing varnished cloth tape

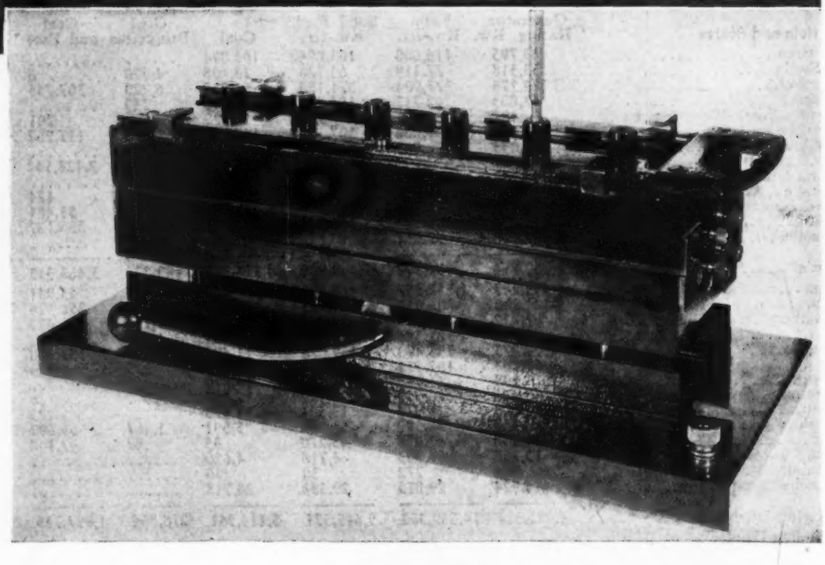
Two pieces of rubber tape of the proper length are placed side by side about $\frac{5}{16}$ in. apart. The cloth tape is then placed centrally along the space between them, pressing lightly on the edges of the cloth tape to make it adhere to the rubber. This keeps it in place while another length of rubber tape is applied along each edge and directly on top of the lower rubber tapes. After aligning the tapes it is necessary to press them together firmly, the rubber tapes fusing together and sealing the edges of the sample; putting the separator sides of the rubber together insures maximum fusion. The specimen is then put in the tester which brings pressure to bear on the rubber, causing it to conform to the irregularities of the cloth surface and thoroughly sealing the edges against flashover.

Satisfactory results are obtained with rubber tape passing A. S. T. M. specification D-119-28 T, provided care is exercised in applying it to the specimen. For aligning the various lengths of tape, a board with pegs spaced the proper distance apart has been found very useful.



Tape testing table in research bureau of Brooklyn Edison Company

Automatic voltage regulator in foreground and tester shown connected to 30-kv. testing transformer in background.



Modified A.S.T.M. type tester in locked position with electrode in place

Handle at left operates cam which locks halves of tester together against pressure of heavy springs in base.

Keeping Sand Out of Turbines and Forebays

By R. P. WAITE
*Central Power Company, Grand Island, Neb.**

ANY discussion on the sand problems which affect hydro-electric operation on prairie streams must be theoretical, because the economics of the present situation are such that it will not pay to build the necessary works for taking care of sand, either in new hydro-electric plants or even in old plants now operating. This statement is made in the beginning, as a careful engineering study has revealed the fact that on account of the erratic flow conditions the kilowatt-hours produced by Nebraska streams hardly justify extensive improvements involving considerable expenditures.

The Platte River is especially a most erratic performer. During the winter months mush ice and anchor ice form in the channel and divert the flow of water away from the headgates at the canal entrance, causing a loss of hydro operation. And during the summer months demands of irrigators on the river above the headgates take practically the entire flow of the river, making hydro-electric operation impossible.

In the Loup River the stream is confined to narrow banks, with the result that it is somewhat swifter in current flow than the water in the Platte. In the winter, however, mush ice and anchor ice form extensively. These not only divert the flow of the channel, but in many instances completely dam the river, causing an overflow and a consequent backing up of the river until the ice jam has been broken. During this period, of course, hydro-electric operation is impossible. During the spring and summer months, on account of the swift movement of the water in the Loup River, the fine silt and quicksand in the bed of the river are constantly in suspension.

Sand bars across the channel and sand in the waterwheels

At points where the water is quiet the sand and silt settle out, diverting the flow of the stream to other channels. The effect of this condition is felt rather keenly in the forebay at the Boelus plant of the Central Power Company, as the swift-flowing river, carrying the sand, comes into quiet water, depositing the sand, forming a bar. This sand bar creeps slowly but surely toward the headgates at the canal entrance, cutting down on the capacity of the forebay and making it necessary eventually to perform an operation known as "scouring" the forebay.

Scouring is accomplished by shutting the headgates on the canal and opening the Tainter gates on the dam, allowing the river to flow down its old channel. The drop in water elevation between the forebay and the river bed below the dam is sufficiently great to cause a swift rush of water, which takes out the sand bar. This scouring operation, however, requires from one day to several days to complete, and naturally a loss of production is suffered during this time.

When the waterwheel is in operation there is also a flow of sand-laden water into the canal, depending largely upon the amount of load which is carried on the waterwheels. If the load is small the sand deposits near the headgates; if the load becomes greater, the current in the canal becomes swifter and the sand is carried further down the canal before it deposits. This has a tendency to build up the bed of the canal, cutting down on the available water supply, thereby decreasing the production. It is necessary, therefore, at certain times to scour the canal by opening the floodgates to their widest point, draining out, by a swift current, all of the water, thereby pulling out the sand, or by picking up maximum loads on the machine and carrying this sand through the waterwheels. The latter method, of course, imposes considerable wearing on the waterwheels, especially on water-lubricated bearings and on runner vanes.

Water pressure bearings prevent wearing of shaft and sleeve

At the Kearney plant of the Central Power Company considerable trouble has been experienced on water-lubricated bearings, due to the sand and silt cutting not only the surface of the *lignum-vitæ* bearings, but the shaft as well. Various methods have been tried to correct the condition. These included sleeves of a hard, tough material on the worn shaft, but this did not stop the wearing of the bearings, and as the shaft between the generator and waterwheel is something like 57 ft. long, the wearing of the *lignum-vitæ* bearings caused the shaft to whip objectionably. Finally water pressure bearings were devised, using clear water at a pressure considerably in excess of that in the shaft tunnel. This kept the sand out of the bearings and, as far as the intermediate bearings have been concerned, has solved the problem very nicely.

Sand problems can be solved, and if the economic conditions were such as to make such work advisable hydro-electric plants with relatively small sand troubles could be built in Nebraska. The ideal method, of course, would be to confine the sand-laden stream to such a section that the velocity of the water would carry the sand from a mile or two above the headgates down through the canal and plant into the tailrace. Such a method naturally means narrowing the stream section above the headgates by dredging and rip-rapping above the dam, sheeting the canal in the curves and rip-rapping or jetting the sides on the straightaways. It also means that the water-wheels must be so designed and built that they will handle the sandy condition of the water without undue wear. This involves a redesign of the present type of waterwheels, eliminating *lignum-vitæ* or hard rubber water-cooled bearings, making all bearings on the unit either oil-pressure bearings or grease-pressure bearings. Possibly the blades on the runner would have to be covered with lead or some other non-abrasive material to prevent the wearing action of the sand.

A "skimmer" would work

Another method is to provide a so-called "skimmer" in the headgates to remove the sand before it enters the canal. This is suggested as a secondary possibility, provided conditions will not permit the ideal situation. While such a method provides for keeping the sand out

*Based on paper presented at a recent meeting of the Engineering Section, Middle West Division, N.E.L.A.

of the stream, it is also wasteful of water. The design of such a skimmer contemplates that the skimmer section be great enough to permit a flow, over the top, of sufficient water to meet full-load requirements on the waterwheel. When the sand banks up on the top of the skimmer the waste gate must be opened and the stream flow taken through the banked-up sand, washing it out of such waste gate. This operation will consume perhaps only a short time and would not materially cut down on the flow of water in the canal, except during periods of actual scouring.

Flushing sand away wastes water

Another method involves a waste-way in the hydro plant to take the sand through the canal but not through the fills. The sand is permitted to settle out in the canal until such a time as it materially affects the operation of the waterwheels. At this time the waste gate in the plant is open and all of the water in the canal taken in the wasteway, thence into the river. In this way the bottom of the canal is again scoured of sand. This method obviously is very wasteful and will not work effectively where the canal is long. In case the canal is longer than 2 or 3 miles we would suggest the installation of additional waste gates along the canal banks at distances of perhaps every 2 or 3 miles in order that the canal may be scoured progressively, starting at the waste gate nearest the plant and progressing upward in the canal toward the headgates.

Under any condition, the water power in Nebraska is such that it must be backed by a sufficient amount of steam energy to handle load requirements. Most of the Nebraska streams are shallow and winding. Ice forming in the winter causes them to become practically dry at times, and no solution of the sand problems will meet such condition. In our operation of water power in Nebraska we have about come to the conclusion that such water power is incidental and can only be taken at times of high water, and even then can hardly be relied upon, due to the destructive action of the sand.

▼ ▼ ▼

Concrete Duct Cheapest When Feasible

THE following estimates were prepared for a large industrial development where installation conditions were favorable for all types of conduit work. They were reported by L. C. Peterman of Ford, Bacon & Davis, New York City:

Estimate of Cost of 100-Ft. Subway Exclusive of Manholes, Paving and Overhead Charges

	Cost for Eight 4-In. Ducts	Cost per Duct Foot
Monolithic concrete	$196.00	$0.25
Fiber	240.00	.30
Tile	259.00	.33
Iron	594.00	.74

Since monolithic concrete, machine cast, possesses all desirable qualities in high degree and is also the cheapest, its use should be carefully considered wherever conditions permit. It is appreciated that in many locations subsurface obstructions and the necessity for special conduit formations rule out this type of construction.

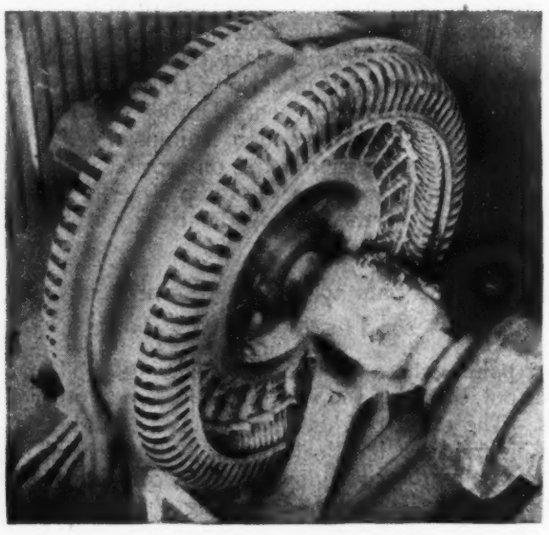
Fiber conduit is satisfactory when installed in dry location. Strength after installation is adequate when imbedded in concrete. Speed of installation is greater than for tile, but is less than for monolithic concrete.

For short sections, small jobs and irregular and special construction the vitrified tile, giving the same high grade of construction as the monolithic concrete, may be more economical. Tile is entirely fireproof, is very slow to deteriorate and has adequate strength when imbedded in concrete. Some breakage previous to installation is unavoidable, but this is not an important objection. Speed of installation is slower than any other material and the cost is 32 per cent more than for monolithic concrete.

Iron conduit may be necessary where bends are numerous and for special purposes, such as laterals and services. It is, however, subject to deterioration from rusting, and in the presence of recurring moisture rust may completely fill up the space between the interior surface of the conduit and the cable, preventing pulling out the cable, or, in the case of a vacant conduit, may so restrict the interior area that future cables cannot be installed. The speed of installation is about the same as fiber conduit.

▼ ▼ ▼

In a Dusty Location



THE large air gap, inherent in the synchronous motor, permits advantageous use of that type of machine in places where the closer clearance between rotor and stator of the induction motor might make maintenance a more demanding job. Profiting by this virtue and, in addition, the one of power-factor correction, this 100-hp. synchronous motor, built by the Electric Machinery Manufacturing Company, runs practically continuously in the plant of the Funkhauser Company at Charmia, Pa. It drives three 30 x 16-inch balanced Sturtevant rolls in the production of rock dust for use on prepared shingles. The dust, all pervasive in the plant, is exceedingly abrasive and clogging and makes motor maintenance in the ordinary case a continually pressing problem.

Surplus Power for Sale

UTILITY managers have long been alive to the desirability of building up smooth load curves by the sale of their surplus power. Some have succeeded in finding a market for their off-peak kilowatts; others have been less fortunate, either because of unfavorable local conditions or their own lack of foresight and initiative in finding customers and creating a market for their surplus energy.

Most utility men agree that the power produced off-peak is, in most cases, produced at little above the cost of the fuel required for the additional operation of the plant. And they agree that the big problem is to find the customers who will take their load during the irregular off-peak hours.

One utility says that it is difficult to find industries which can use intermittent surplus power whenever it is available, and that such power if marketed may develop into firm power in the future. They believe that contracts for surplus power should not extend over a long period or provide for sales at too low a price, and that the customer taking surplus power risks building up a business based on low-price power and then finding his supply cut off as system load factors improve.

Another utility finds that one of the major difficulties encountered in the distribution of surplus power generated by a manufacturing company is the cost of transmitting that energy to the point where it can be utilized. If it is to be absorbed by the central station, a substation must be installed at the point of generation and transmission provided to some load center where the central station can utilize it. In one such case the cost of those facilities amounted to $325,000. Moreover, such surplus would be of little value to the average central station unless the supply is firm power and can be relied upon at the time of the central-station peak.

In cases where surplus power might be sold to an industrial concern producing its own power, the economies which make it possible for the central station to sell the surplus power at low cost also make it possible for that industry to produce additional power at low cost. In other words, in buying surplus power, when, as and if available the industry would be reducing the load factor or use factor of its own power-producing equipment, with the result that such power as it would produce itself would increase in cost. Of course, there might be some resultant advantage due to differences in efficiency of fuel utilization.

Unfortunately for the utilities, the industrial establishments are as much concerned with load factor as the utilities themselves. Large power-using industries rarely conduct their operations on one shift or over a period of only eight hours out of the twenty-four, since they must make their plant investment as productive as possible. Consequently, it is difficult to find an industry which would operate and use large blocks of power, say, between the hours of 10 p.m. and 6 a.m. at any rate for power which a utility could make.

In most industries power is only a small item in the total manufacturing cost, a factor which makes it unprofitable for them to have their production impeded by the irregularity and inconvenience of off-peak rates.

However, in spite of all these impediments to the sale of surplus power, utilities that are taking the initiative are finding off-peak markets. Some are making campaigns in their localities to electrify the kitchens in hotels and restaurants and to install electric ovens in the bakeries. Others are working in the domestic field selling electric ranges, refrigerators, electric heating systems and household appliances. Other utilities having industries in their locality which, by the nature of their work, are permitted to operate at off-peak hours are arranging special rates and selling them on the economy of off-peak power consumption. Electrochemical industries, cement factories, refrigeration plants and ferroalloy manufacturers are included in the off-peak customer list of various central stations.

One utliity is so arranging its load that the valley in the load curve comes at a time when it can deliver all its surplus energy to other companies on their interconnection. Interconnections which serve a wide variety of consumers often afford ideal markets for surplus energy. One electrochemical plant is buying surplus power as, when and if available with the self-assurance that it will have power 24 hours a day, with not more than one or two breaks during a year. Others are probably willing to do the same.

Whenever surplus power is marketed utilities find that it must be sold in the sense that it is a sound investment for the consumer, and not as something which yields only a fair return to the central station producing it. The utilities must study the needs and requirements of their prospective customers and show them wherein surplus power is a "good buy."

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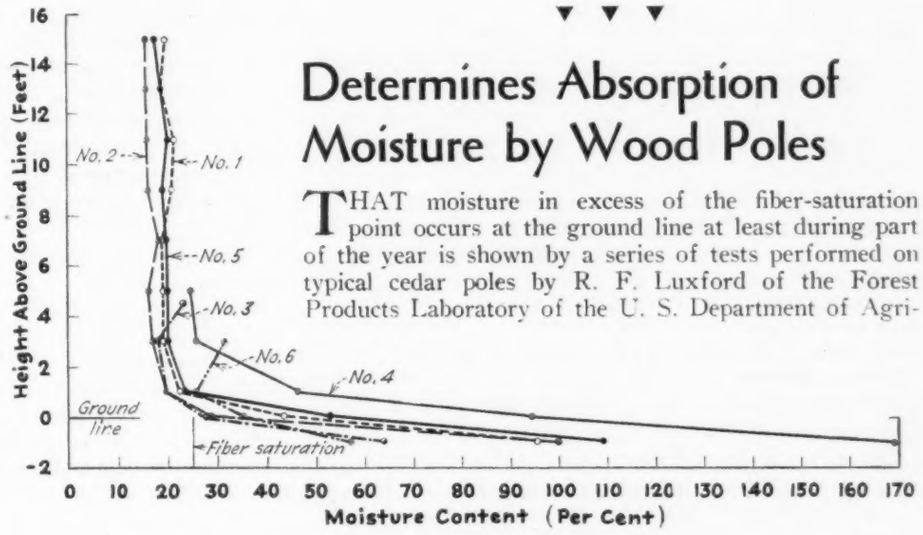
Determines Absorption of Moisture by Wood Poles

THAT moisture in excess of the fiber-saturation point occurs at the ground line at least during part of the year is shown by a series of tests performed on typical cedar poles by R. F. Luxford of the Forest Products Laboratory of the U. S. Department of Agri-



Average moisture content of cedar poles

culture at Madison, Wis. This justifies the present practice of designing pole lines on working stresses that would be considered proper for green material, since the strength of wood in the fiber-saturated condition is essentially the same as that of green wood and since experience has shown that failure is likely to come at the ground line.

The six poles used for the test were cut into sections corresponding to 1 ft. below the ground, the ground line, 1 ft. above, and then every 2 ft. until either a height of 15 ft. or the top of the pole was reached. Three-quarters of each section was dried as a whole to determine the average moisture content of the section. The remaining one-quarter was divided along suitably spaced arcs struck from the center of the section to determine the moisture-content contours of each piece.

It was found that at the ground line all poles were above, or at most only slightly below, the fiber-saturation point (approximately 25 per cent) and, as far as the effect of moisture is concerned, were no stronger there than they had been when green. Below the ground line the moisture-content values increased rapidly over the length examined, while above it they decreased slightly, in general maintaining values of 15 to 21 per cent for the rest of their height.

Detail moisture-content contours for all the poles were determined. These contours appeared to indicate that after installation the butts of the poles absorbed moisture during the wet part of the year, that the outer part of the butt dried to some exent during the summer, and that the extreme outer shell of this outer part had again absorbed moisture during the fall rains that occurred just before the removal of the poles.

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READERS' FORUM

Buyers and Sellers of Hydro Equipment

To the Editor of the ELECTRICAL WORLD:

In a recent issue of the *N.E.L.A. Bulletin* (August, 1930) appears an article by a member of the staff of one of the leading hydraulic turbine manufacturers which discusses the relationship between the builder and the buyer or operator of this type of power plant equipment. One does not have to read between its lines to infer that he thinks that "something is rotten in Denmark."

It is the old, old story of the differing interests and viewpoints of buyer and seller, which the author did well to attempt, with much success, to present from a rather new angle. He briefly calls attention to the just claims and rights of patentees of meritorious devices and of business organizations having the services of superior engineering and construction talent and facilities to offer the customer. Apparently it well sums up the existing situation as it is seen through the eyes of some, if not most, of the turbine builders.

Thus is brought out into broad daylight a situation whose primary causes are economic, plus the failure or disinclination of one or both of the parties oftentimes to consider the viewpoint and necessities of the other in a co-operative manner.

The march of progress, the recurrence of severe droughts, and the changing requirements and conceptions as to absolute reliability, base-load and peak-load operation, etc., have so altered the economics of hydro vs. steam power that throughout a large part of the United States, at least, the balance is frequently close, or adverse to water power, except at the more favored sites.

The power companies, therefore, are often in a position to choose between fuel- and water-generating sources, which are on an approximate economic parity. If the choice goes to the former, the turbine manufacturers have lost one more potential job in a field which is continually narrowing through the rapid development of the favorable sites and the progressive elimination of others from further consideration. In other words, the further development of water power is a matter of primary concern to the equipment manufacturers, while in many cases it is of secondary importance to the power producer.

There appears to be objection on the part of some manufacturers to the growing disposition of power company engineers to question efficiencies, etc., and the tendency to resort to model and full scale tests of turbines and appurtenances made in company or university hydraulic laboratories, or at hydro power stations. On the other hand, there is the more or less justified refusal of the builders to give out "trade secrets" which might benefit a competitor.

Bearing, as they do, the heavy responsibility of selecting, recommending and installing the best to be had for the money, it is not strange that power company engineers are insistent upon exhaustively going into every phase and detail of performance on which such tests may be expected to shed light. Especially is this desirable to secure valid comparisons of rival devices, under test conditions as nearly identical as possible and closely simulating the full-size service setting.

Whether it is pleasing to the hydraulic machinery builders or not, power company laboratories and tests will continue to multiply and the results to be disseminated until it is apparent that there is no more to be learned thereby. A co-operative attitude toward these experiments should pay substantial dividends, both in data obtained and the closer contacts with those concerned with the purchase of equipment.

Conversely, the skirts of the power industry are not too clean because of more or less adequate foundation for the complaint that such machinery is often bought as "hardware," the order going to the lowest bidder on the basis of guarantees which are not always truly comparable. The remedy is twofold, namely, (a) the education of those responsible for specifications and for purchasing, to a proper appreciation of the facts and requirements, especially as to the true value of relative reliability and of increments of efficiency in terms of the *total cost of the plant,* and (b) the making of tests, such as those described, sufficient truly to compare the competing claims and equipment.

From every angle, therefore, except possibly the disclosure of non-patentable methods or devices, or those undergoing development, both parties have tremendously more to gain by whole-hearted co-operation than by secretiveness and obstructive tactics.

A UTILITY ENGINEER.

Men of the Industry

J. C. De Long Chairman of Board in Syracuse

JAMES C. DE LONG has retired from the presidency of the Syracuse Lighting Company, Inc., Syracuse, N. Y., to become chairman of the board of directors. He will continue to take an active part in the affairs of the company and will serve in an important advisory capacity. He is a veteran among public utility leaders. This year he completes 51 years in public utility work, 23 of which were served as an officer of the Syracuse Lighting Company. In 1907

he removed from Philadelphia to Syracuse as vice-president and general manager of the lighting company, three years later being elected to the presidency.

During his term of office the Syracuse company developed and expanded its holdings along all lines. In the last year of Mr. De Long's tenure of office the Syracuse company became a unit of the Niagara Hudson Power System and recently announced plans for the execution of a three-million-dollar improvement program.

Mr. De Long's first connection with the public utility industry was as manager of the Utica Electric Light Company. Subsequent connections followed with the Russell Engine Company, the Thomson-Houston Company at Lynn, Mass., and with the Toledo Electric Company. He again transferred his interests to the East as manager of the Eastchester Lighting Company at Mount Vernon, N. Y., and later he served as electrical engineer for the United Gas Improvement Company of Philadelphia. When the U.G.I. acquired an interest in the Syracuse Lighting Company Mr. De Long was sent to Syracuse.

He has also been a leader in other fields. He served as president of the Syracuse Chamber of Commerce and is now a director of the Syracuse Trust Company. He is completing twenty years of continuous service as a member of the executive committee of the Empire State Gas and Electric Association, an organization of which he was also president.

Mr. De Long was badly injured at Rome on September 13 when he was struck by an automobile. He had been visiting friends in that city and was crossing a downtown street when the accident occurred. He was taken to the Rome Hospital, where, at this writing, it is reported that his injuries will not prove serious unless complications develop. Mr. De Long sustained a slight fracture of the skull, a broken rib and an injury to the hip. It is expected that he will be confined to the hospital for several weeks.

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A. DEAN DUDLEY, vice-president of the Syracuse Lighting Company, Syracuse, N. Y., has been elected president to succeed James C. De Long, who becomes chairman of the board of directors.

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GEORGE C. KING has been made merchandise manager in the sales department of the El Paso Electric Company, El Paso, Tex., to succeed J. P. Boyden, who left for Tarkio, Mo. Mr. King was formerly a power salesman with the company.

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RAY P. TARBELL, formerly Cleveland district sales manager of the Lincoln Electric Company, has recently become a member of the firm of Robert E. Kinkead, Inc., consulting welding engineers, Cleveland. As vice-president and secretary he will assist Robert E. Kinkead in his executive duties. The welding field is one in which Mr. Tarbell has been actively engaged for many years. He entered the employ of the Lincoln Electric Company in 1918, subsequently joined the sales force and later was named district sales manager in Cleveland.

G. E. Lewis Managing Director Rocky Mountain Division

A NEW MANAGING DIRECTOR, George E. Lewis, took charge of National Electric Light Association affairs in the Rocky Mountain Division September 1 under the new organization set-up. The appointment of Mr. Lewis consolidates under one head the various National Electric Light Association's local committees and groups, subject to formal ratification by the regional convention at Albuquerque, N. M., October 20, whereby the Colorado, Wyoming and

New Mexico Utilities Associations pass out of existence, along with the Rocky Mountain Committee on Public Utility Information, of which Mr. Lewis has been executive manager since 1922.

During Mr. Lewis' incumbency as head of the information unit many innovations along publicity lines were made in the Rocky Mountain Division and became widely practiced. A newspaperman with twelve years reportorial experience, the incoming managing director for the Rocky Mountain Division has a background that fits him admirably for the type of work in which he has been and is now engaged. His more comprehensive duties will be directed from offices in the Gas and Electric Building, Denver, Colo., which have been headquarters of the information committee since its inception eight years ago.

J. P. BOYDEN, formerly merchandise manager of the El Paso Electric Company, El Paso, Tex., has been named sales manager for the eastern division of the Western Public Service Company. His headquarters will be at Tarkio, Mo., from which point he will supervise sales activities in some 24 small towns in Missouri, Kansas and Nebraska. He has been connected with the Texas utility since 1927, when he severed his connection with the Baton Rouge utility, where he occupied the position of illuminating engineer. He was named merchandise manager in El Paso in the summer of 1928. Mr. Boyden is a native of Maine. His first experience in the Stone & Webster organization was obtained in the Boston office.

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R. P. PRIEST has been appointed supervisor of safety for all the Tenney companies. Mr. Priest is well qualified to carry on this work, having been assistant supervisor of safety since 1925. He has been doing work for Charles H. Tenney & Company and associated companies for many years. Entering the employ of that organization as a member of the engineering department in 1918, he served as resident engineer and in other engineering capacities.

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GEORGE S. JONES, JR. has been appointed manager of the public utilities division of Frigidaire Corporation to succeed W. R. Winans, who has been assigned to the Eastern region, with offices in New York. Mr. Jones was for three years manager of the Southwestern region. Before joining the Frigidaire organization he was assistant general manager of the Dallas Power & Light Company and prior to that connection had various utility affiliations in Georgia and Texas. GEORGE DURBAN has been made assistant manager of the utilities division.

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GEORGE L. KNIGHT, mechanical engineer of the Brooklyn Edison Company, was the guest of honor at a dinner at Oetjen's restaurant, Brooklyn, given on September 10 by more than 150 employees of the mechanical engineer's department of the company. The dinner was in celebration of Mr. Knight's completion of 25 years service with the company and an engraved gold watch was presented to him. Mr. Knight received an electrical engineering degree from Drexel Institute in 1900. In 1905 he went to the Brooklyn Edison Company from the New York Edison Company, where he had been chief draftsman of the Waterside station. He assumed similar duties with the Brooklyn Edison Company until 1908, when he became designing engineer in charge of all design and building construction. In 1923 he was appointed mechanical engineer in charge of mechanical and civil engineering design and construction. In 1922 he was made chairman of the engineering committee, responsible for the design and construction of the Hudson Avenue generating station. Mr. Knight is a past-president of the Brooklyn Engineers' Club. He was a manager of the American Institute of Electrical Engineers from 1922 to 1925 and was vice-president of that organization for two years from 1926. He is a trustee of Engineering Foundation, Inc.

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OBITUARY

Frank R. Ford

FRANK R. FORD, of Ford, Bacon & Davis, Inc., consulting engineers, New York, and a prominent figure in public utility and industrial engineering, died September 17 in the Medical Center, New York, following an operation. He was 59 years of age. Mr. Ford was born in Philadelphia and received his technical education at the University of Pennsylvania, having been graduated in 1890. Entering upon the work to which he was to devote his life, he became a member of the firm of Ford, Bacon & Davis in 1894. His extensive interests brought him in contact with various industrial enterprises. In the course of his career he was chairman of the executive committee and a director of the Lackawanna & Wyoming Valley Railroad Company, Scranton & Wilkes-Barre Traction Corporation, Empire State Railroad Corporation and a director of the United Railways Investment Company, Benedict Stone Corporation, Syracuse Washing Machine Corporation and in addition president and director of the L. C. Smith & Corona Typewriters, Inc. From 1917 to 1921 he was a member of the New York and New Jersey Port and Harbor Development Commission and for the next three years a member of the Port of New York Authority. Mr. Ford was a member of the American Institute of Electrical Engineers, the American Electric Railway Association, Franklin Institute and other professional organizations.

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Lorenzo J. Scott

LORENZO J. SCOTT, executive vice-president of the United Electric Light Company, Springfield, Mass., died in the Springfield Hospital September 13, following an operation for appendicitis. He was taken ill September 10, while attending a meeting of the executive committee of the Western Massachusetts Companies in Boston, and as soon as the nature of his trouble was determined he was driven to Springfield and arrangements made for the operation immediately.

Mr. Scott entered the employ of the United Electric Light Company in 1895 as a meter reader and clerk and his record with the company was marked by steady advancement. He became assistant manager in 1907, general manager in 1920 and executive vice-president in 1928. He was a trustee and member of the executive committee of the Western Massachusetts Companies.

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Theodore I. Jones

THEODORE I. JONES of the engineering firm of T. I. Jones, Inc., and formerly general sales agent of the Brooklyn Edison Company, was suddenly stricken with a heart attack in Newark September 12 and died on the way to a hospital. He was 51 years of age. Before establishing offices in New York as a consulting engineer Mr. Jones was vice-president and general manager of the Radford Company, the Pneum-electric Corporation and the American Flexible Shaft Manufacturing Corporation.

For a period of sixteen years Mr. Jones served as general sales agent for the Brooklyn Edison Company and in this capacity made an enviable record as an organizer and executive. His reputation as an authority on electrical subjects resulted in his being engaged by the Department of Education of the city of New York in 1913 to deliver a series of lectures. While he was affiliated with the Brooklyn utility he also served as chairman of the Commercial Section of the National Electric Light Association, in which society he had taken a prominent part as a member of various committees.

A graduate of the Massachusetts Institute of Technology, Mr. Jones engaged at first in telephone work for the American Telephone & Telegraph Company and for the New York & New Jersey Telephone Company. Leaving the telephone field early in 1907, he became illuminating engineer with the Nernst Lamp Company in New York, a Westinghouse corporation, and while in this position he was called upon to organize the sales department of the United Electric Light & Power Company of New York, becoming its first sales manager. From the United he went to Brooklyn. Mr. Jones was a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society and other engineering associations, before which he delivered numerous papers.

Financial and Statistical News

BULLISH factors bearing directly or indirectly on the market this week include a rise in foreign trade, an advance in grain prices, a slight increase in steel, electric power and coal production and in car loadings. Market buying and selling points have become remarkably well defined and news now reacts more promptly.

——THE BOND MARKET CONTINUES FIRM despite the heavy volume of new issues. Demand fostered by low money rates keeps a pace ahead of supply. Institutional buying is reported unusually heavy.

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Hartford Customers to Receive Dividend

CUSTOMERS, STOCKHOLDERS AND EMPLOYEES of the Hartford (Conn.) Electric Light Company will share in a distribution of approximately $375,000 to be made by the company in October. The customers' dividend is a 40 per cent reduction on October bills and will amount to about $250,000. Employees will receive about $50,000, or a bonus of 40 per cent, of their October earnings. Stockholders of the company will receive an extra dividend of 40 per cent of the accrued October dividend, a disbursement of about $75,000.

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June Customer-Ownership Sales $10,700,000

JUNE CUSTOMER-OWNERSHIP STOCK SALES show an increase over May, but fall below June of last year by nearly $3,000,000. It is estimated that sales during the month amounted to $10,700,000; the number of shares sold was 153,300 and the number of transactions 19,200, according to monthly reports received by the ELECTRICAL WORLD from central-station companies selling stock directly to customers, employees and others.

More than half the total sales were made by five large companies, indicating heavy purchases of stock in widely differing types of territory. One company alone reported a quarter of the total, in an eastern industrial state, but this was approached by the combined sales of two company groups in the much more sparsely settled agricultural states in the upper Mississippi valley. Heavy sales were reported also from California.

There was considerably more activity in the first six months of this year than in the corresponding period of last year, sales being $78,862,000 in 1930 and $63,813,000 in 1929, as shown in the accompanying table.

Customer Sales Ahead of Last Year's

Month	1930	1929
January	$9,412,000	$15,833,000
February	13,000,000	6,139,000
March	15,500,000	5,383,000
April	21,400,000	7,470,000
May	8,850,000	15,588,000
June	10,700,000	13,400,000
Six months	**$78,862,000**	**$63,813,000**

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Recent Listings

The New York Stock Exchange has authorized the listing of 25-year 6 per cent debentures of the Berlin City Electric Company dated April 1, 1930, due April 1, 1955, to the amount of $15,000,000. The New York Stock Exchange has also authorized the listing of 144,245 shares of 5 per cent preferred stock, par $10, of the Philadelphia Company on official notice of issuance in exchange for outstanding certificates for preferred 5 per cent stock (par $50) in the ratio of five new shares for each share of preferred stock (par $50).

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Power Basis of South's Development*

By P. S. ARKWRIGHT
President Georgia Power Company

THE productive capacity of man—in agriculture and in industry—depends upon the amount of power he uses, not on fertility of soil, not on climate, not on natural resources, but preponderantly on power.

The nations of the world rank in wealth and prosperity in the ratio of the number of times through mechanical power they have multiplied their manpower.

The growth of prosperity in the South has been coincident with the growth of electrical development in the South. Both have grown at an accelerating pace in the last few years.

In the last five years the percentage of increase in capacity and output of electric generating stations and in the number of electrically wired homes in the South has exceeded the average percentage of increase in the nation as a whole.

From 1912 to 1929 the developed horsepower in the South has increased more than 600 per cent, compared to an increase in the remainder of the United States of 400 per cent.

The electric power production by utilities in the South increased more than 700 per cent in the period 1912 to 1929, as compared to an increase in the entire United States in the same period of 400 per cent.

At the beginning of 1930 the developed water power capacity in the South was approximately one-third of the total developed water power capacity in the entire country. Since 1908, while the rest of the United States doubled its hydro-electric capacity, the South has more than trebled its developed water power.

The number of electric customers in the South increased from 693,622 at the end of the year 1912 to 4,597,827 at the end of the year 1929, or an increase of 577 per cent, as compared to an increase in the remainder of the United States of slightly more than 400 per cent.

New wealth, greater opportunities

In the four years 1925 to 1929 the number of homes receiving electric service in the South increased 40 per cent, as compared to an increase in the entire United States of about 33 per cent.

During the period of six years 1923 to 1929 the number of farms served with electricity in the South increased

**From talk before Institute of Public Affairs, University of Virginia, Charlottesville.*

300 per cent, while in the entire United States they increased about 240 per cent.

Additional investment to the amount of $2,182,000,000 has been made in the electrical development in the South since 1912, being an increase in such investment of about 700 per cent, while the increase in investment in electrical development in the entire United States in the same period amounts to about 450 per cent.

The territory has been gridironed with electric transmission lines. In the South was constructed the first interconnected system of high-voltage, long-distance, major transmission lines. Such interconnected transmission system not only originated in the South but interconnection has been utilized in the South to a larger extent than in any other section of the country.

It has resulted in many benefits and operating economies which have been passed on to the consumer in improved service and in lower rates. It means also that the entire resources of the interconnected system are behind each customer's switch in the territory, just as if Nature in the beginning had made all the rivers flow right by the confines of each community in the area and had underlaid the surface of each of such communities with all of the coal fields of the territory, placing at their fingertips the force of the falling waters and the energy stored through the centuries in the fuels.

The value of industrial production in towns of 10,000 population or less in the United States in 1925 was only slightly less than the value of industrial production in the entire country in 1909.

The economic and social advantages of the decentralization of industry are immeasurable. Such decentralization is made possible by the availability of electric power supply in the small places as well as the large, and by the uniformity of rate structure, and results in benefit to the entire section through a lower cost of finished goods, better living conditions, lower tax rates, lower manufacturing costs, wider distribution of wealth and the comforts and conveniences which go with it, and conservation of the capital invested in manufacturing plants by saving the necessity of relocating plants on account of the disadvantages brought about by concentration of industry in the larger cities and the consequent congested living conditions, high land value, high tax value, and dissatisfied employees.

Decentralization of industry and the diffusion of industry with agriculture are mutually beneficial to both agriculture and industry. Along with other benefits, it stabilizes agriculture in that the payrolls of industry increase purchasing power and provide a home market for agriculture, thereby stimulating a diversity in agriculture in contrast with the old one-crop system, at the same time reducing the cost of living and affording a more wholesome atmosphere and environment, and better living and social conditions for the factory workers.

Billions in new wealth

Electric light and power companies have invested something like two and a half billion dollars in facilities in the South. This huge investment has been added to the wealth of the South. It was impossible to secure this capital within the South. It has been obtained from the leading banks, the leading investment houses, the leading investors throughout the entire United States. They were induced to invest their moneys in this enterprise because they were convinced of the economic success of the enterprise and the security of their investment and their expected return.

Their experience has justified their faith. No interest on any bond and no dividend on any preferred stock of any electric light and power company in the South is in default. Through the electric industry the interest and attention of investors have been attracted to the South. Their experience has proved satisfactory. They have been led to believe in the South. This would not follow through government development, for moneys are loaned to government not on the economic soundness of the enterprise but on the taxing power of the government.

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NEW CAPITAL ISSUES

Consumers Power Company made an offering of first lien and unifying mortgage 4½ per cent bonds at 101½ and accrued interest, to yield more than 4.40 per cent, a piece of financing involving a total of $20,000,000. The company will use the proceeds of this financing to reimburse its treasury in part for expenditures made on additions and improvements. These securities mature in 1958.

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Seaboard Public Service Company issued 100,000 shares of $3.25 no-par convertible preferred stock, with warrant, the price being $47 per share, to yield 6.9 per cent.

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Electric Power & Light Corporation issued 100,000 shares of cumulative $6 preferred stock, the price being $100.50 a share and accrued dividend from October 1, 1930, to yield over 5.95 per cent. This company entered the market last week with an offering of debentures totaling $15,000,000. Proceeds from the sale of this stock, together with that of the sale of the debentures, will be used for the retirement of current indebtedness, for working capital and for other corporate purposes.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Baton Rouge Electric (Year ended July 31)					
Gross earnings	$1,342,441	$1,190,725	12.7	..	..
Net earnings	489,845	453,510	8.0	..	..
Eastern Texas Electric & constituent Cos. (Year ended July 31)					
Gross earnings	10,181,757	9,126,791	11.5	..	..
Net earnings	4,249,510	3,829,379	11.0	..	..
Eastern Utilities Associates (Year ended July 31)					
Gross earnings	9,376,774	9,007,789	4.1	..	..
Net earnings	3,813,160	3,523,668	8.2	..	..
El Paso Electric & constituent cos. (Year ended July 31)					
Gross earnings	3,638,203	3,368,002	8.2	..	..
Net earnings	1,581,433	1,406,729	12.4	..	..
Electric Power & Light & Subs. (Year ended June 30)					
Gross earnings	63,649,342	57,385,076	10.9	50	52
Net earnings	31,484,837	27,569,880	14.2	..	..
Engineers Public Service & Constituent Cos. (Year ended July 30)					
Gross earnings	52,445,743	43,971,573	19.4	57	57
Net earnings	22,239,905	18,438,369	20.6	..	..
Galveston-Houston Electric & Subs. (Year ended July 31)					
Gross earnings	4,983,387	5,248,755	—5.0	..	..
Net earnings	1,552,690	1,706,682	—9.0	..	..
Puget Sound Power & Light & Subs. (Year ended July 31)					
Gross earnings	17,042,685	15,810,406	7.8	..	..
Net earnings	7,283,678	6,576,827	10.8	..	..
Savannah Electric & Power (Year ended July 31)					
Gross earnings	2,220,300	2,206,964	0.6	..	..
Net earnings	1,036,887	997,470	3.9	..	..
Sierra Pacific Electric & Subs. (Year ended July 31)					
Gross earnings	1,449,340	1,419,713	2.1	..	..
Net earnings	623,186	631,481	—1.3	..	..
Tampa Electric & Subs. (Year ended July 31)					
Gross earnings	4,586,240	4,586,581	—0.0	..	..
Net earnings	1,532,280	1,461,766	5.1	..	..
Virginia Electric & Power & Subs. (Year ended July 31)					
Gross earnings	17,188,030	16,767,686	2.5	..	..
Net earnings	7,753,534	7,458,334	3.9	..	..

August Manufactures Start Rise

AFTER a downward movement that started in the early summer of 1929 general manufacturing activity in the United States as a whole apparently made the upward turn in August. The gain over July operations was slight, only a fraction of 1 per cent, but it came after an uninterrupted decline that carried the July index 15.5 per cent below the temporary peak of last February and 25 per cent below the maximum reached in February, 1929, according to monthly returns received by ELECTRICAL WORLD on electrical energy consumed for power purposes in some 3,800 manufacturing plants.

August operations were 17.6 per cent lower than in August, 1929, and 12.5 per cent lower than in August, 1928. For July the corresponding comparisons give 18.5 and 12.6 per cent respectively. For the first eight months the average was 13.2 per cent lower than in 1929.

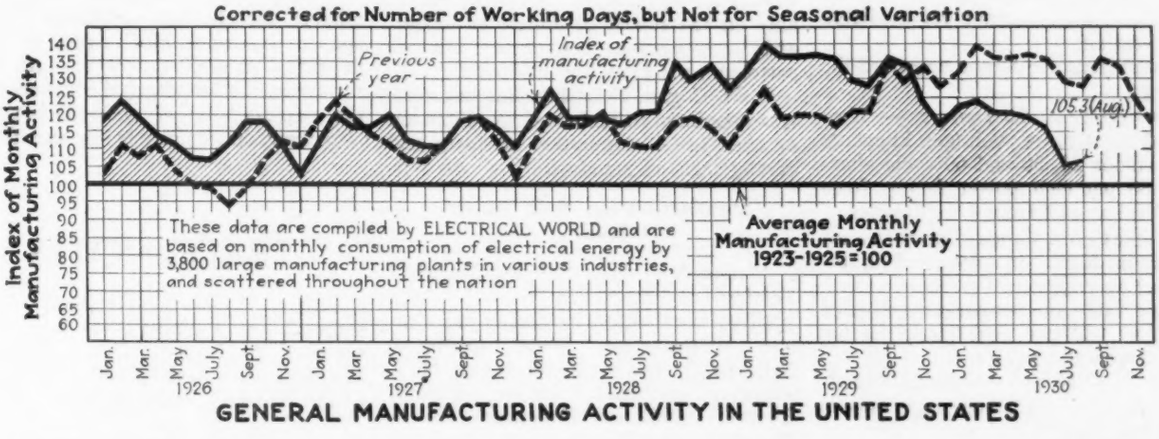
The gain was general. In New England the rise over July, lowest month in six years, was 4.5 per cent; textiles, leading industry, rose 15 and metal working plants 4 per cent. The North Central States advanced 2 per cent; the automobile industry 12 over July's low. The South gained 3 per cent, despite a further decline in textiles whereby the nation-wide average for that industry was carried down still further.

Exceptions to the general upward movement are the regional averages for the Middle Atlantic States and the West. In the former the decline continued, with August 8.3 per cent under July.

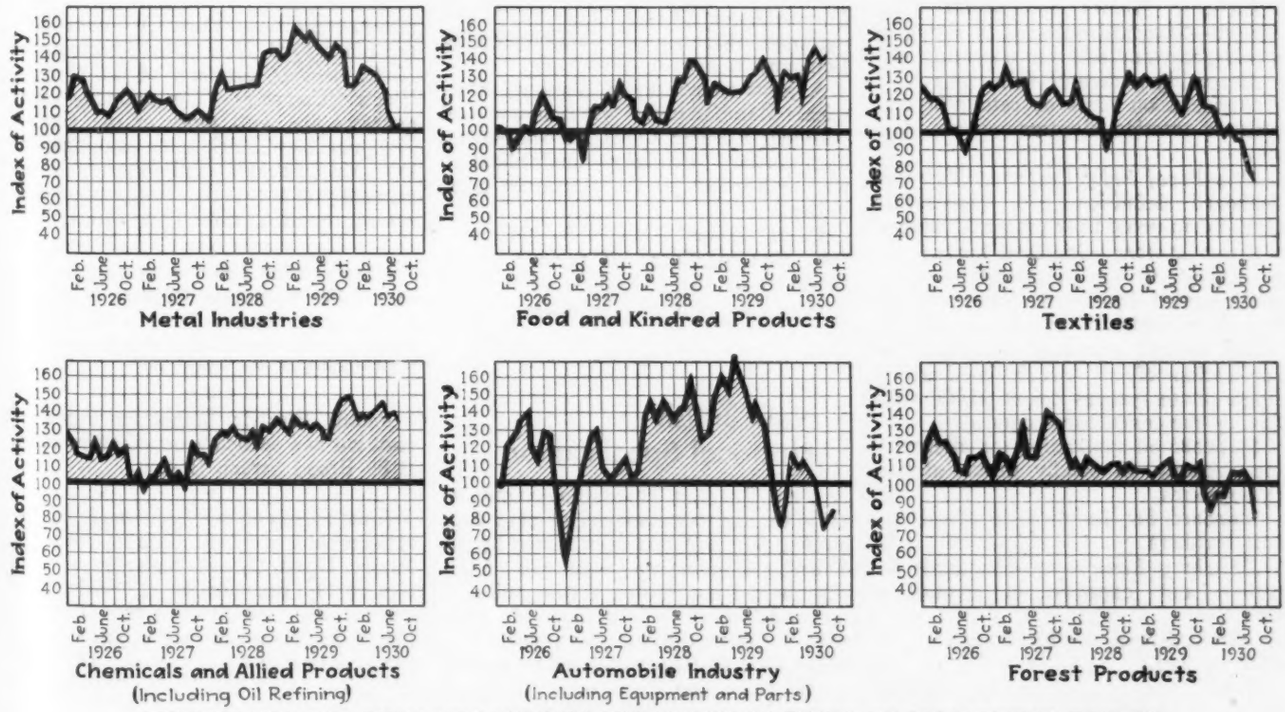
Current Manufacturing Compared With Other Periods

(Per Cent Change)

Industrial Group	August, 1930, and July, 1930	August, 1930, and August, 1929	First 8 Months 1930 and First 8 Months 1929
All industry	+ 0.2	—17.6	—13.2
Chemical products (including oil refining)	— 3.5	+ 8.5	+ 6.4
Food products	+ 1.4	+ 6.7	+ 6.7
Steel plants	+ 2.0	—25.7	—17.5
Metal working	+ 0.1	—19.3	—19.6
Leather products	— 9.8	—14.3	— 6.7
Lumber products	—18.7	—10.7	—10.4
Paper and pulp	— 3.9	— 6.9	— 0.4
Rubber products	+ 6.4	— 8.0	—11.3
Shipbuilding	+ 5.0	+26.2	+11.1
Stone, clay and glass	+ 6.7	—25.0	—18.4
Textiles	— 9.0	—34.1	—13.6
Automobiles (incl. parts and access.)	+15.0	—29.4	—34.2


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
105.3(Aug.)
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

New Standards on Generators, Motors and Switchgear Approved

THE standards committee of the National Electrical Manufacturers' Association approved a number of new standards on generators, motors and switchgear at a meeting held in New York August 5. Some of the standards approved and other standardization activities are here outlined. A complete list of the changes is not yet available for publication.

The standards committee approved the following:

Engine-Driven Alternators — New standard ratings of voltage, kilowatts and speed for 25, 50 and 60 cycle alternators, 80 per cent power factor, from 1 to 8,000 kw. and from 4 to 90 poles.

New rules on a standard performance specification blank, on overspeed limitations and on position of terminals.

A new table on temperature rise of 40 deg. C., 80 per cent power factor engine-driven alternators.

Planer Type Motors—Standard speeds and speed ratios for planer type motors having 4 to 1 and 6 to 1 speed ratios.

Elevator Motors and Motor Generators—Standard on basis of rating of motor-generator sets for operating elevators using generator field control.

Standard on basis of rating of d.c., gearless traction elevator motors, class DL.

Drip-Proof Fully Protected Motors—Standard definition and temperature rise of drip-proof fully protected motors.

Crane Motors—Standard horsepower and speed ratings of open-type intermittent-rated slip-ring a.c. crane motors, from 2 to 300 hp, 60 and 25 cycles.

Oil Circuit Breakers—Standard on application of oil circuit breakers to single-phase systems below 66,000 volts having one conductor grounded.

Standard on application for interrupting capacity on solidly grounded-neutral systems.

Standard for drain valves of oil circuit breakers.

Switching Equipment—Standards for rating and capacity of grounding switches.

Standard steel specifications for outdoor stations.

Transformer Impedance—Change in the standard tolerance factor for impedance volts of distribution transformers.

Attachment Plugs—Standard terminal dimensions for small table heating appliances.

A. S. A. standardization

The standards committee authorized N.E.M.A. representatives to vote favorably on the report of American Standards Association committee D2 on petroleum products and lubricants.

C. M. Cogan, N.E.M.A. headquarters, was appointed to replace S. N. Clarkson on the A.S.A. committee on form and arrangement of standards.

Standardization with outside bodies

A joint committee with the Electrical Testing Laboratories in connection with quality improvement programs on electric ranges has been appointed, N.E.M.A.'s representatives being: H. J. Mauger, chairman, Edison General Electric Appliance Company; E. A. Rutenber, A. J. Lindemann & Hoverson Company, and Frank Thornton, Westinghouse Electric & Manufacturing Company.

A joint committee of National Electrical Manufacturers' Association and National Electric Light Association on high-tension porcelain standardization was authorized by the standards committee.

E. H. Hubert, N.E.M.A. headquarters, was appointed to replace S. N. Clarkson as the N.E.M.A. representative to the Producers' Council.

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New British Electrical Specification

A NEW BRITISH STANDARD SPECIFICATION for the performance of desk type electric fans has just been issued by the British Engineering Standards Association and constitutes a companion to that relating to ceiling fans. It deals with the small diameter high-speed propeller type of fans which relate to this performance and gives tests by which it may be ascertained. Dielectric tests and limits of temperature rise are also specified.

Five new specifications for non-ferrous metals have been issued, and a revision of the specification for carbon-filament glow lamps has been issued, bringing it into line with that for tungsten-filament lamps. The clauses in the two specifications now correspond and the lamps are rated in lumens instead of in candles.

In a revision of the specification for electric cable soldering sockets for cables from 0.003 to 1.00 sq.in. sectional area, the design and dimensions of cast and tubular sockets have not been altered, but an important modification is made in that hot-pressed sockets are now recognized as standard, the material for the manufacture of such sockets and also their dimensions being specified.

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TRADE NOTES

Curtin-Howe Corporation, timber preservation engineers of New York, removed its Chicago office to 20 North Wacker Drive and opened a new office in the Security Building, Minneapolis.

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Schweitzer & Conrad, Inc., have moved their New York City metropolitan office to 8 West 40th Street, under K. C. Beckett, formerly of the General Electric Company. The company's new quarters are with those of the Cutler-Hammer New York sales organization, but Mr. Beckett will operate independently of the Cutler-Hammer organization, reporting directly to Chicago.

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Offices of the exterior lighting section of the Westinghouse Electric & Manufacturing Company have been moved from South Bend, Ind., to the Cleveland works of the company.

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Pacific Electric Manufacturing Corporation has opened a new factory office at 89 Broad Street, Boston.

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Announcement has been made of the appointment of E. S. Conrad, formerly Pacific Coast district manager for the Square D Company, to the position of general sales manager of the Diamond Electrical Manufacturing Company with headquarters in Los Angeles. Diamond Electrical is affiliated with the Square D Company.

BUSINESS ON DEAD CENTER

BUSINESS hesitates on dead center. Feeble signs of returning business health exist, but they are few. And they are almost overbalanced by the unfavorable factors still existing.

Steel output is up slightly, but demand has not enlarged appreciably. Four blast furnaces have been blown out so far this month, but ingot production will probably be somewhat higher in September than in August.

Soft coal production, electric power output and carloadings show somewhat more than seasonal increase. This and a slight rise in currency in circulation indicate some growth in diversified manufacturing, employment, payrolls, wholesale and retail trade.

Commercial loans and bank credits as a whole are not expanding at the usual seasonal rate—certainly not as fast as they should at this time for marked business recovery.

Commodity prices have moved through a narrowing range of fluctuations since the first of the month. It is now fairly clear that bottom has been reached. The duration of the bottom, however, is yet uncertain.

Apex Electrical Manufacturing Company has entered the electric refrigeration field, according to C. G. Frantz, president. The manufacture and sale of the new refrigerators will be handled by a separate refrigeration division of the company.

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Birtman Electric Company and subsidiaries report for quarter ended June 30, 1930, net profit of $36,893 after charges and federal taxes, equivalent after allowing for dividend requirements on the $7 no-par preferred stock to 21 cents a share on 125,400 shares of common stock. This compares with $70,733, or 48 cents a share, on 125,400 common shares in preceding quarter and $68,981, or 58 cents a share, on 100,015 shares of common stock in second quarter of 1929.

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Neon Lamp Soon for General Use

A NEON LAMP designed for general use may soon be on the market. The perfection of a new type of neon tube which, it is claimed, may be used for domestic lighting is announced by Raymond R. Machlett, who has been a pioneer in the development of neon tube signs. It is claimed that the new tube eliminates the necessity of transformers and high voltage required to actuate tubes now in use and can be used on 110-volt circuits. Mr. Machlett is reported as saying:

"The new lamp preserves the inherent advantages of neon lighting, such as efficiency, long life, high economy and cold light, and at the same time reduces the cost enormously. This lamp may be screwed into a socket just as incandescent lamps are now used. It will lend itself to use for interior lighting, carrying with it a therapeutic value because of the presence of ultra-violet in its discharge. By proper combination the present lamps may be applied as a source of light more nearly approximating daylight than is practicably possible with incandescent lamps."

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New-Kanawha Power Co. Lets $1,000,000 Contract

THE NEW-KANAWHA POWER COMPANY, subsidiary of the Union Carbide & Carbon Corporation, has awarded a contract to the Westinghouse Electric & Manufacturing Company approximating $1,000,000. This contract calls for delivery and erection at customer's power house of four 30,000-kva., three-phase, 6,900-volt, 25-cycle, 150-r.p.m. vertical waterwheel generators with direct connected and pilot exciters.

A dam is being built at Hawks Nest on the New River and water is being delivered to the power house through a 16,500-ft. tunnel under 140 ft. head. Power will be transmitted at 66,000 volts to the Boncar industrial plant and it is reported will be used principally in electric furnaces. This voltage is employed on account of the large block of power to be transmitted.

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Copper Price Lowest in Thirty Years

COPPER SOLD IN THE DOMESTIC MARKET at 10½ cents delivered in the East, the lowest price since January, 1902. August statistics on lead released this week revealed a gain in stocks and a moderate decline in shipments, but this had no influence on sellers, for the tone remained steady.

Lower prices resulted in a fair volume of business in copper, though the sales total for the week fell a little short of that reported for the preceding week.

	Sept. 10, 1930 Cents per Pound	Sept. 17, 1930 Cents per Pound
Copper, electrolytic	10⅜	10½
Lead, Am. S. & R. price	5⅛	5⅛
Antimony	8	7¾
Nickel, ingot	35	35
Zinc, spots	4.60–4.65	4.60
Tin, straits	29.90	29.85
Aluminum, 99 per cent.	23.30	23.30

The price range was 10¾ to 11 cents delivered Connecticut, until September 12, when a moderate tonnage sold at 10½ cents, though a few scattered lots brought 11 cents on the same day. By Monday the news of the decline spread sufficiently to bring out a fair buying interest, and though the large producers held out for 10¾ cents, the bulk of the business was transacted on the basis of 10½ cents.

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DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

Number of Accounts Reported

Division	August 1929	August 1930	Per Cent Increase or Decrease	Eight Months 1929	Eight Months 1930	Per Cent Increase or Decrease
New York	314	251	—20.0	2,095	2,422	+15.6
Middle and Southern Atlantic States	178	143	—19.6	1,305	1,333	+ 2.1
New England	106	102	— 3.7	1,133	990	—12.6
Central Division	578	659	+14.0	5,036	6,031	+19.8
Total	1,176	1,155	— 1.8	9,569	10,776	+12.6

Total Amounts Reported

Division	August 1929	August 1930	Per Cent Increase or Decrease	Eight Months 1929	Eight Months 1930	Per Cent Increase or Decrease
New York	$62,309	$28,292	—54.6	$408,303	$403,889	— 1.0
Middle and Southern Atlantic States	22,886	28,514	+24.6	187,792	214,283	+14.1
New England	19,494	7,141	—63.3	160,119	138,684	—13.3
Central	69,747	63,059	— 9.6	614,624	797,195	+29.7
Total	$174,436	$127,006	—27.2	$1,370,838	$1,554,051	+13.4

Market Conditions

WHOLESALE orders on the Pacific Coast are larger this week, but staple items are moving slowly. Hand-to-mouth buying persists in the Eastern district. Volume has advanced somewhat, but there are few indications of any substantial increase in immediate buying.

——SMALL POWER EQUIPMENT SALES ARE ACTIVE in New England, while volume of business is light.

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EASTERN

—WHILE THE MARKET TONE *for electrical equipment in the Eastern district shows considerable improvement over that of a few weeks ago, hand-to-mouth buying continues to prevail. Manufacturers anticipate a sizable influx of commitments if inquiries during the past fortnight can be taken as an indication of what is ahead.*

—THERE HAS BEEN A *lively advance in the volume of call both for central station and industrial equipment, but with price, unquestionably, an important factor in the transaction. Jobbers report trade as dull, with little immediate encouragement in sight. The demand for electric refrigerators continues strong and business in that quarter is good.*

The United States Steel Corporation has placed a large contract for heavy equipment for its Carnegie mills in the Pittsburgh district with the Westinghouse Electric & Manufacturing Company, totaling close to $300,000, to be used in connection with an expansion and betterment program now under way. Iron and steel account shows better immediate promise in other quarters and it is estimated that there is well over $1,000,000 in business in sight for mill motors, controls and other equipment in the Chicago, Cleveland, Youngstown and Pittsburgh steel centers. Oil refining is another attractive branch of activity for early commitments; chemical account is picking up and shows good prospects, while demand for motors and auxiliary equipment from metal-working plants has better proportions than for several months past.

Motor account with central stations shows improvement according to a Pennsylvania manufacturer, with stronger call for larger size units; generator business, also, looks more promising for the next 60 days. A manufacturer of inter-office and factory telephone apparatus reports trade as good, with business for the past few months showing an advance of about 25 per cent over the corresponding period of a year ago.

The Westinghouse Electric & Manufacturing Company has secured an award for propulsion machinery from the government, including high-pressure turbine units and accessories for the battleships *Pennsylvania* and *Arizona*, now being reconditioned, totaling about $500,000. The International Mercantile Marine Company is expected to enter the market for the construction of three new turbo-electric passenger and cargo vessels, with a heavy complement of electric apparatus.

CONSTRUCTION PROJECTS

R. H. Macy & Company, New York, department store, plan automobile service and garage building with storage and distributing plant at Brooklyn to cost over $150,000. Department of Property and Supplies, Harrisburg, Pa., will receive bids until September 24 for additions and improvements in electrical equipment at State Teachers College, Millersville. Pennsylvania Railroad Company, Pittsburgh, Pa., plans yard and shop improvements at Oil City, Pa., to cost $130,000. Gulf Refining Company, Pittsburgh, Pa., contemplates refining plant near Cincinnati, Ohio, to cost over $1,000,000. Department of Commerce, Washington, D. C., will receive bids until September 26 for gasoline-electric engine generator plants (Proposal 22569). Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until November 5 for a refrigerating plant for naval base at Honolulu. (Specification 6005.)

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SOUTHEAST

—THE TONE OF ELECTRICAL BUSINESS *in the Southeast in the past week was quiet, with the sales volume only reasonably good. Indications are that there will be no noticeable pick-up in activities until the late fall at the earliest.*

A Louisiana utility company ordered $10,000 in circuit breaker equipment, while a Florida power company ordered 35,000 lb. of bare and 25,000 lb. of weatherproof copper wire. A Georgia company placed orders for 32,000 lb. of solid and stranded copper and creosoted pine poles amounting to $2,200. The latter company also ordered three 250-kva. and three 100-kva transformers. A paper mill in Louisiana was responsible for the largest order reported last week, the amount being $165,000 for motor equipment. Other orders are in immediate prospect from this same mill. Contracts have been let covering the construction of a 25-ton ice plant in an east Georgia town and this job involves $5,000 apparatus and installation, a 150-kva. substation and the construction of 1½ miles of line. An order for elevator equipment approximating $45,000 will be placed within the next couple of weeks for an office building being constructed in Atlanta.

CONSTRUCTION PROJECTS

Virginia Public Service Company, Charlottesville, Va., plans extensions and improvements in distributing and lighting system at Waynesboro, Va. Wheeling, W. Va., contemplates installation of airport lighting system. Monongahela-West Penn Public Service Company, Clarksburg, W. Va., has filed plans for a power substation to cost $50,000. Nashville Cold Storage Company, Nashville, Tenn., plans cold storage and refrigerating plant to cost $60,000. Champion Fibre Company, Canton, N. C., contemplates extensions and improvements in mill to cost over $100,000.

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NEW ENGLAND

—LITTLE INTEREST IN *heavy electrical machinery was reported during the past week and no orders of interest were noted. Negotiations continue for a number of turbo-generators, though little pressure behind these inquiries is in evidence.*

—SMALL MOTOR SALES *are fair, the volume recently reported for this district by one prominent manufacturer comparing well with that of last year, though some sagging in sales is reported by others.*

A number of large motor sales, for ratings up to 50 hp., were noted to meet requirements for pumping and institutional purposes. Small power equipment sales are gaining, according to one manufacturer. Small switches and control orders are in better volume than last week. General scheduled materials are moving rather unevenly, though wire, line hardware, fiber conduit and new construction needs for house wiring are meeting with encouraging demand.

Outside of the industrial equipment situation, the interest in this district is centered in lighting equipment. Demands for institutional lighting units have been very encouraging; floodlighting units are in less demand, and on the other hand, high-wattage lamp sales have increased due to the interest developed in outside illuminated fields.

Some specialties are showing increasing favor; one recent installation of over 500 electric clocks is of interest. Nearly 300 electric range sales were reported for Maine during a recent drive.

CONSTRUCTION PROJECTS

United Electric Light Company, Springfield, Mass., has plans for a coal-handling plant at power station to cost over $50,000. A. H. Hews & Company, Cambridge, Mass., plans flower pot manufacturing plant to cost over $100,000. New Bedford, Mass., has plans for a vocational school for girls to cost over $250,000. Danbury & Bethel Gas & Electric Company, Danbury, Conn., plans equipment storage and distributing plant to cost about $60,000.

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MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section continues to show a slight improvement. The volume of business is gradually increasing and better business conditions are definitely in sight. Inventories are admittedly low and a resumption of general purchasing is not far distant. While the recovery is necessarily slow, it is generally felt that the trend of business is upward.*

—ENCOURAGING REPORTS FROM THE *steel industry, together with increased carloadings, are creating a more optimistic attitude. Retail trade is apparently receiving the benefit of fall business, as buying has been resumed in most lines except luxuries.*

Various utility companies are conservatively proceeding with plans for expansion, while considerable circuit revision work is going on. Some of the interesting items placed this week include oil circuit breaker equipment to cost $52,000, insulation of piping system to cost $80,000, 150 10-kva., single-phase, 2,200-volt overhead type distribution transformers, and 3,000 5-amp. watt-hour meters.

CONSTRUCTION PROJECTS

Crane Company, Chicago, Ill., will build a plumbing equipment factory branch and distributing plant at Milwaukee, Wis., to cost $110,000. Wausau Motor Parts Company, Wausau, Wis., contemplates plant unit to cost close to $100,000. Oakland Foundry Company, Belleville, Ill., plans plant to cost over $150,000. Otis Steel Company, Cleveland, Ohio, plans strip and plate mill to cost over $450,000. Blooming Prairie, Minn., plans municipal electric light and power plant. Minnesota Power & Light Company, Duluth, Minn., will proceed with steam-operated electric power plant reported to cost over $350,000. Central States Electric Company, Cedar Rapids, Iowa, contemplates power plant at Eldora, Iowa, to cost $75,000. Fort Dodge Gas & Electric Company, Fort Dodge, Iowa, plans extensions and improvements in power plants and system to cost about $500,000.

PACIFIC COAST

—MANUFACTURERS REPORT A FAIR AMOUNT *of machinery business on special order, but a poor movement for staple items and sizes. Wholesalers report a definite increase in the size of orders and much figuring and estimating by contractors.*

—REAL ESTATE SALES *are perceptibly better and are actually better than for several years past, so that general belief is that the deepest valley of business depression has been passed.*

The outstanding order covers 166 miles of copper cable from Anaconda for the Pacific Gas & Electric Company's Mokelumne project. Two carloads of Westinghouse ranges totaling $25,000 are reported for Seattle. The city of Woodland is preparing a $125,000 street-lighting installation, comprising about 250 units. Power apparatus orders cover a $9,500 switching equipment for station G in San Francisco and an outdoor switch house for an irrigation district. All irrigation districts are buying in considerable quantities. About $50,000 worth of distribution transformers and $30,000 worth of switchgear are expected to be bought in San Francisco in the next week. Miscellaneous business includes $3,000 worth of wire and supplies for a municipal water department, a $50,000 railroad lamp contract, a projected $10,000 floodlighting job for a San Joaquin high school and much hospital construction in Oakland, Palo Alto, Stockton and San Francisco, also Riverside, where a $1,000,000 sanitarium is projected. Prospective major construction is unusually heavy, including a $1,000,000 addition to Hotel Delmonte, a $1,250,000 storage and distributing general petroleum station for San Francisco, the $1,200,000 Paramount theater for Oakland and the monumental 44-story $3,500,000 hotel to be erected just outside of the Los Angeles city limits, where the 150-ft. rule does not apply.

Although sales volume continues light, several jobbers report that recent inquiries for motors and accessories from lumber and pulp mills have materialized into small orders, with indications of increasing buying from these sources. Reporting sales of $12,000 worth of miscellaneous switchgear to central stations in Washington during a ten-day period, one manufacturer's representative is optimistic over fall business. Motor sales announced include 50 machines from 100 hp. down to lumber and pulp mills and allied industrials; another 23 machines from 30 hp. down to mills and dealers and another eighteen machines from 50 hp. down to irrigation and miscellaneous sources. Wire sales are reported light, lamp movement fair and range sales normal. City of Seattle is taking bids for approximately 350 cedar poles for its lighting department, having rejected all bids for about $15,000 worth of excitation and regulation equipment for Lake Union steam auxiliary and awarded contracts for $8,000 worth of glass insulators and locust pins.

CONSTRUCTION PROJECTS

Midland Counties Public Service Corporation, Fresno, Calif., will build transmission line to Creston, El Pomar and vicinity to cost $90,000. American Rubber Producers, Inc., San Francisco, Calif., will build a plant at Salinas, Calif., to cost $150,000. General Petroleum Corporation, San Francisco, Calif., plans storage and distributing plant in North Beach district to cost $900,000. Baker Oil Tool Company, Los Angeles, Calif., has plans for plant to cost $120,000. Hood River, Ore., has approved plans for a hydro-electric power plant to cost close to $100,000. Seattle, Wash., has filed plans for a power substation. Northern Utilities Corporation, Jamestown, N. D., plans transmission line from Cut Bank to Shelby, Mont., to cost $65,000. Dillon, Mont., will ask bids for an ornamental lighting system. Jack Waite Mining Company, Wallace, Idaho, plans expansion program at mill and properties to cost over $300,000.

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SOUTHWEST

—GENERAL CONDITIONS ARE ABOUT *the same as last week. Manufacturers report business a little better, with more orders for stock sizes, but generally smaller quantities, indicating cautious buying. No doubts are expressed of an early return to normal volume.*

A Missouri power company bought a 1,500-kw. turbo unit for $50,000 and an Arkansas utility contracted for switching equipment for two substations to cost $7,000.

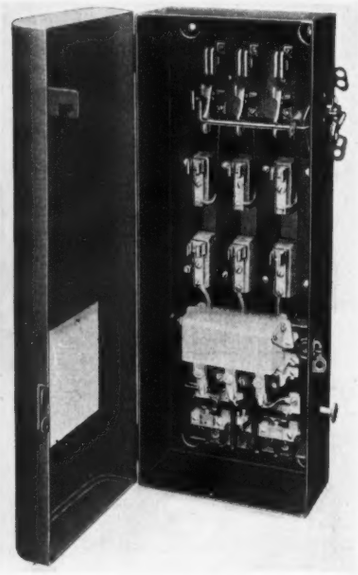
CONSTRUCTION PROJECTS

Stearman Aircraft Corporation, Wichita, Kan., has filed plans for plant to cost over $300,000. Kansas Power & Light Company, Topeka, Kan., has filed plans for power substation to cost about $50,000. Woodward, Okla., plans municipal power plant to cost $125,000. Oklahoma Electric & Water Company, Beaver, Okla., plans extensions in power plant and system reported to cost over $60,000. Elk City, Okla., plans ornamental lighting system. Muskogee, Okla., plans municipal power plant to cost $80,000. Texas & Pacific Railroad Company, Fort Worth, Tex., has plans for freight terminal with electric and mechanical equipment to cost $1,600,000. Dallas Power & Light Company, Dallas, Tex., has plans under way for a hydro-electric power plant to cost over $500,000. Mississippi Portland Cement Company, Jackson, Miss., recently organized, plans mill to cost more than $1,000,000.

New Equipment Available

Starter and Switch Combined in Cabinet

COMBINATION alternating-current starters comprising an automatic starter and a quick-make and quick-break knife switch mounted in the same cabinet are announced by the Industrial Controller



Division of the Square D Company, Milwaukee, Wis.

These switches are provided with arc suppressors and will break the stalled-rotor current of motors that are within the rating of the starters. Low voltage and overload protection are provided by the starter. An interlock on the cabinet prevents opening the door when the switch is not in the "off" position. The unit is designated by classes 8532K, 8536K, and 8537K.

A saving in space and a reduction in time required for installation and wiring are claimed for these combination starters.

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Adjustable Resistor for High-Wattage Service

ENAMELED SLIDE RESISTORS, which combine the ruggedness and high-wattage characteristics of vitreous enamel resistors with the convenience of being continually adjustable, have been placed on the market by Hardwick, Hindle, Inc., Newark, N. J. This resistor consists of a refractory tube having a resistance wire with a low temperature coefficient of resistivity wound about it, with suitable terminals at each end. This assembly is enameled with a vitreous coating by special process which leaves a small arc of the turns exposed along a straight narrow track. A suitable adjustment band and shoe are employed to furnish contact with the coil at any desired point.

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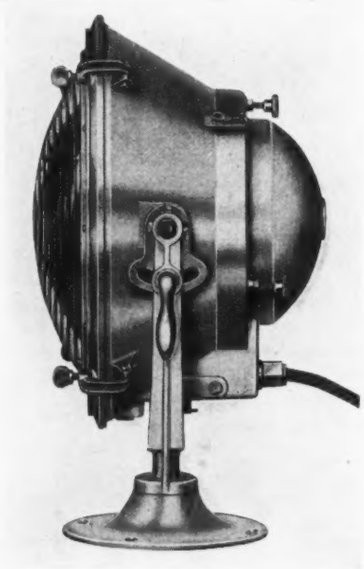
On-Course Light for Night Flying

AIRWAYS ON-COURSE LIGHTS for use with a rotating beacon to give the aviator information as to direction and the proximity of landing fields are announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. These lights have a split spherical mirror 5 in. in radius, of ground, formed and polished optical glass, mounted on a cast aluminum alloy cradle. The cradle is provided with three adjusting screws for focusing.

Peep sights are provided for correctly focusing the lamp. A watertight bushing is [illegible]d at the rear of the body for the [illegible]er-covered flexible cord, 15 ft. of which is furnished with the unit.

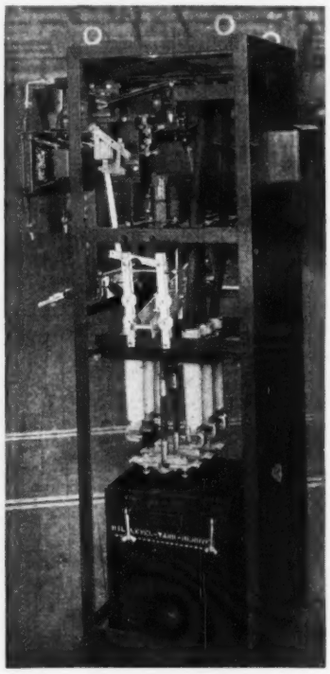
Due to the short focus inner doublet and the deep split spherical reflector the intercepted angle of light flux is unusually high. The beam divergence is



about 5 deg. vertical and 15 deg. horizontal. Since the unit is usually elevated about 2½ deg., the lower edge of the beam is parallel to the horizon. The range of the light is about 5 miles.

Magnetic Switches for Large Size Motors

OIL IMMERSED MAGNETIC SWITCHES for heavy-current duty in controlling large sizes of motors are announced by the General Electric Company, Schenectady. These switches consist of a three-pole,



200-amp., oil-immersed contactor, a temperature overload relay, two current transformers and an under-voltage relay.

Instantaneous under-voltage protection is obtained with one form when used with a drum switch. Time-delay, under-voltage protection is obtained with the other form when used with momentary contact type push-button control.

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Oil Fuses Protect Small Transformers

OIL FUSES FOR THE PROTECTION of feeders and small power and distribution transformers operating on circuits up to 4,000 volts have recently been placed on the market by the Line Material Company, South Milwaukee, Wis. These fuses have high interrupting capacity, which makes them suitable for location close to large systems.

This device has a fuse link holder which disconnects the fuse when the eye is pulled and cannot be disconnected unless the cover is closed. It is protected against internal pressure by its heavy cast-iron tank. Large screened vents in the body casting permit the gases to escape.